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The

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WELLINGTON, NEW ZEALAND.

20TH JANUARY, 1916.

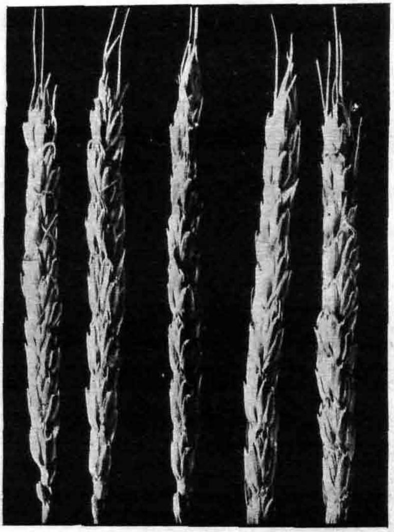
FROST AND WHEAT.

THE DAMAGED CANTERBURY CROPS.

A. H. COCKAYNE, Biologist.

IT is a peculiar phenomenon that wheat, a crop regularly grown in countries far colder than New Zealand, should this season have been severely damaged within the Dominion by a single late frost occurring in the latter part of November. Frost injury to wheat is by no means unusual in parts of Southland, especially on low-lying ground and amongst crops that have been autumn-sown. Generally, however, the injury is confined to patches, and the damage results in the lowering of the yield rather than the total destruction of any one crop. In the Canterbury District, however, serious losses have been sustained this season through frost injury, and in several localities very large areas of wheat have been completely destroyed so far as grain-production is concerned.

In countries with very cold winters frost injury to wheat usually takes the form of killing the plants, due to the protracted freezing of considerable depths of the soil. In certain of those countries extensive damage is also not uncommonly caused by early autumn frosts prior to harvest. Neither of these conditions, however, applies to New Zealand. Frost also occasions damage



WHEAT-HEADS FROSTED IN FLOWERING STAGE AND DEVOID OF KERNELS.

to wheat when in the flowering stage, and again when the grain is young. In the former case the injury causes "blindness" of the heads, due to imperfect fertilization; in the latter the further growth of the young grain is stopped, and shrivelling takes place. Semi-arid conditions combined with frost are liable to be injurious to crops that are just coming into ear where the heads are still protected by the covering sheath of the leaf. This sheath

may become injured, with the result that the heads remain more or less enclosed, never completely breaking through, and thus the crop becomes stunted.

In Canterbury the injurious effects of frost this season are shown in the almost complete failure of many crops to become fertilized, with the consequent result of the production of blind

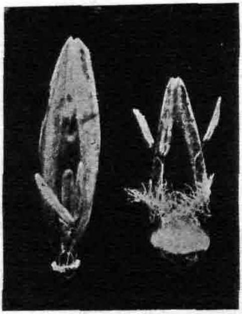
UNINJURED HEADS; TAKEN FROM CROP ADJOINING THOSE SHOWN IN FIRST ILLUSTRATION.

heads. A good many crops that had not fully headed at the time of the frost are also badly injured, but in these the injury has resulted in the general stunting of the plants rather than in the production of ears devoid of kernels. In order to properly realize the significance of frost as an agent in the cause of sterility in wheat it will be well to give a brief account of the normal fertilization of this plant.

FERTILIZATION OF WHEAT.

When the processes of fertilization are about to commence, the glumes (husks) that surround the essential parts of the flower open slightly, and the filaments of the stamens (three in number) commence to lengthen. Those portions of the stamens (anthers) containing the pollen then overturn and at the same time split open, allowing the pollen to fall on the pair of long feathery stigmas that surmount the greenish ovary. This greenish swelling at the base of the glumes contains a single ovule. By means of an outgrowth called the pollen or germ tube a pollen grain is able to reach the egg-cell enclosed in the ovule. A portion of the pollen grain then fuses with a certain portion of the egg-cell, fertilization is thus completed, and a rapid development of the young grain takes place.

These various delicate operations all take place within the glumes, and wheat is thus generally self-fertilized. After fertilization has been effected the glumes separate more widely from one another, and the continued growth of the staminal filaments causes the anthers to protrude beyond the ears. The wheat is then popularly said to be in flower. In reality fertilization has been effected before this stage is reached. It is said that in certain instances cross-pollination may occur after the protrusion of the anthers, but this is unusual.



DISSECTED WHEAT-FLOWERS. — THE ONE ON LEFT FROSTED; THAT ON RIGHT UNINJURED.

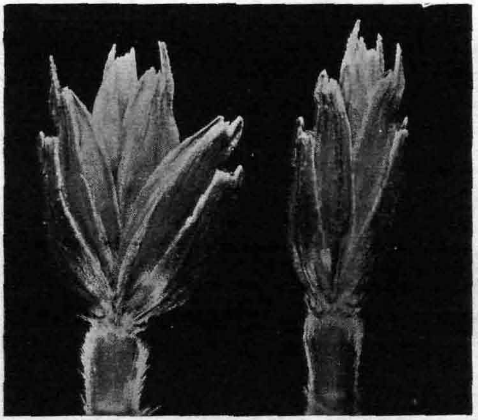
Self-fertilization is said to occur in the early morning, between 5 a.m. and 7 a.m., the whole process lasting only a few minutes. Complete fertilization of all the flowers of an ear, however, takes about four days, not all the flowers opening on the same morning.

EFFECT OF FROST ON FERTILIZATION.

On the night of the 21st November, when the heavy late frost (eleven to fourteen degrees) was experienced in the Canterbury District, a considerable number of wheat crops were just in the stage preceding fertilization. The filaments of the stamens

were on the point of elongating, and, had normal conditions prevailed, fertilization would have occurred within a day or two—in many instances on the very morning when the freezing took place. The frost, however, had the effect of injuring the stamens, and completely stopped their further growth. No opening of the glumes, elongation of the staminal filaments, or falling of the pollen occurred.

In consequence no fertilization at all took place in those crops that happened to be in the stage described. In certain instances



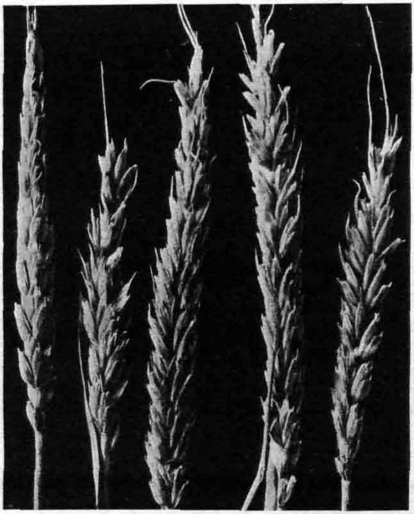
WHEAT-SPIKELETS.—THE ONE ON LEFT WITH PROPERLY MATURING KERNELS; THAT ON RIGHT FROSTED AND DEVOID OF KERNELS.

ears damaged by frost showed the brown remains of the fertilized grain, but this was unusual, and in the vast majority of cases the injury took place prior to the commencement of fertilization. An examination of damaged ears some weeks after the frost had occurred showed the stamens quite bleached, and in exactly the same stage of development as healthy ones just prior to the elongation of the staminal filaments. In all cases where complete fertilization had occurred some days prior to the frost no damage at all was sustained, while adjoining crops just on the point

of fertilization were completely destroyed so far as any grain-production was concerned.

FROST THE CAUSE.

There is not the slightest doubt that frost was the causal agency resulting in the loss of so many crops. In many instances where the crops were located on undulating ground the higher parts more or less escaped while complete destruction of the grain occurred on

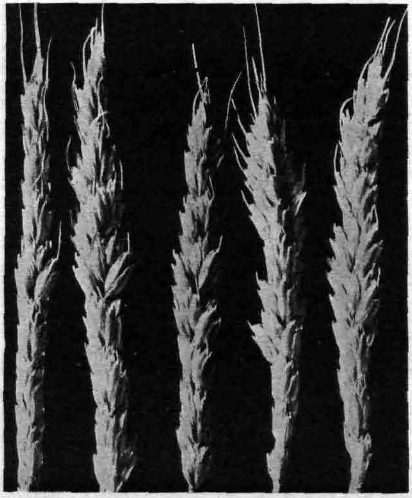


HEADS WITH UPPER PORTIONS FROSTED AND LOWER PARTS DEVELOPING GRAIN.

all the lower portions. This condition was shown perfectly in a 600-acre crop in the vicinity of Woodgrove. About half this crop was on hillside, and the other part on lower flat land. On the hill quite a good crop will be harvested, whereas on the flat the yield would be less than 2 bushels per acre.

In these frosted crops it was noticeable that any heads that

many crops show a sprinkling of uninjured heads that have developed normally. This is most conspicuous with crops that have stooled extensively, the youngest stools not having headed at the time of the frost, and being protected by the higher and older ones. In the case of crops that had not come out into full ear on the night of the 21st November, many of the tips of the exposed ears are bleached, and in other cases the protecting sheath has also been damaged and blackened.



HEADS WITH A FEW GRAINS DEVELOPING, THE REST FROSTED.

TYPES OF CROPS INJURED.

In nearly every case the crops that have failed to become fertilized were autumn-sown. This is not because autumn-sown crops are more prone to injury than spring-sown ones, but simply because they happened to be in that critical stage when frost injury is most liable to occur. In all cases crops that were fully fertilized at the time of the frost, and whose flowers had closed again, were not damaged at all. On the other hand, spring-sown

crops that were not yet in the fertilization stage were injured more or less seriously in those districts where the frost was most severe. The heads of such crops, however, do not show the complete lack of any fertilization seen in those that were on the point of flowering when the frost occurred. In many cases the majority of the flowers have formed grains, but those on the side most exposed are often destroyed. Again, the upper parts of the heads that were just protruding from the sheath show a failure to set seed. Nearly all these spring-sown crops that have been injured more or less, and are growing on soil where the moisture-content is fairly good, have grown well since the frost and will yield fair crops. Those on extremely dry ground were unable to recover from the check to growth caused by the frost, and are in many cases almost complete failures.

AREA AND AMOUNT AFFECTED.

The main areas where extensive frost damage to wheat occurred are located in North Canterbury. In the Hawarden, Waikari, Culverden, and Cheviot districts great losses have occurred, and the majority of the autumn-sown wheat crops in those localities have been completely ruined so far as grain is concerned. Again, in the Oxford, Cust, Rangiora, Clarkville, and Kaiapoi Island districts many crops have been similarly affected. In these districts, however, many perfectly healthy crops can be found, and the damage is almost entirely confined to the crops on low-lying ground. Another broad belt of frosted crops is to be found in the neighbourhood of Springfield, Dalethorpe, Sheffield, Coalgate, Hororata, and Racecourse Hill. Further south a considerable amount of frost injury has occurred, especially in the Fairlie and Waitaki districts.

On the whole, I estimate that quite 12,000 acres of wheat have been totally ruined, and in addition to this there is a very large area where the frost has caused a very considerable diminution in the yield. If the losses sustained are culculated at 15,000 acres, and it is reckoned that normally this area would have averaged the moderate yield of 25 bushels, the loss due to the single night's frost can be roughly set down at 375,000 bushels. This at 5s. per bushel would mean a monetary loss of nearly £100,000.

THE UTILIZATION OF FROSTED CROPS.

Fortunately those crops that are useless so far as grain-production is concerned have a very considerable prospective value provided they are cut for chaff before the foliage begins to wither away. It has been recognized that all those crops quite devoid of kernels

are useless for any other purpose, and the majority of farmers, as soon as they recognized their condition, have cut them for chaff. In many cases quite good crops of chaff will be secured, varying from about $1\frac{1}{4}$ tons to $2\frac{1}{4}$ tons per acre. This chaff, although not as good as that from crops containing normally developed grains, will be quite a saleable commodity, and should realize a price more than covering the cost of its production.

HEADS FROSTED WHEN STILL ENCLOSED IN SHEATH LEAF, SHOWING HOW PROPER DEVELOPMENT HAS BEEN CHECKED.

When viewed in this light the actual loss sustained by the frost will not be anything like as serious as one might be led to suppose. Owing to the prolonged dry weather experienced in the province, it seems clear that many parts of Canterbury will be very short of feed next winter. A plentiful supply of wheaten chaff should therefore prove extremely valuable for local consumption, apart from any consideration of exportation to Australia, where the prospects

of fairly high prices for such chaff are good. Again, much of the oaten sheaf crop in Canterbury and elsewhere is exceedingly short in the straw this season, and the utilization with it of wheat chaff will probably be very generally adopted in certain districts.

PRECAUTIONS.

The loss due to frost, although a regrettable one, is not likely to recur—at least, for many years. The last time that any appreciable loss was sustained from this cause was some nine years ago, and even then the damage done was nothing like as extensive as has been the case this season. Still, it would seem well for farmers growing wheat in districts liable to heavy late frosts to avoid sowing on low-lying land, confining this crop to the higher and warmer ground.

SOFT LIMESTONE ON THE GUM LANDS.

B. C. ASTON, F.I.C., Chemist to the Department.

SINCE August, 1913, when I reported on several samples of soft, easily-weathered marly limestone from Redvale, the principle of using local soft limestone deposits has been given a trial on the gum lands of that area of country lying behind the North Shore of Auckland City.

The soil in general is poor and difficult to work. In the virgin state it carries a scanty growth of low manuka and other native shrubs. The chief native grass is *Danthonia semiannularis*, while a creeping fern, *Gleichenia dicarpa*, is everywhere common. The country has been well turned over by gum-diggers, and even by settlers, who, by exploiting the fossil kauri-gum of their holdings, have in some cases made sufficient to fence them.

After personally making a few visits to the district in company with Mr. R. Rowan, Fields Inspector, and examining the Redvale limestone deposits, which contain from 65 per cent. to 81 per cent. of carbonate of lime, it was decided to carry out experiments with large dressings of the raw stone as drawn from the quarry. The deposit appeared easy to work, the hill upon which the limestone outcropped being close to the main road, and drays backed into the face could easily be loaded from above by means merely of

pick and shovel. Some pioneer work has been done by Mr. George Lepper, who, having dressed his garden with a large quantity of the raw limestone, has demonstrated the value of it by the improved condition of his soil, which before the lime was applied was most difficult to work. The quarry from which the stone is drawn is on private property, and 6d. per ton royalty is charged by the owner.

In order to prove conclusively to farmers that the rough stone could be utilized without any treatment, a series of experiments was laid down at Albany, within easy distance of Auckland, where the Department had some plots under Mr. Rowan's supervision, the idea being that the limestone should be applied to the land just as it was taken from the quarry, and that the lumps should be allowed to disintegrate in the soil in the course of the usual farm operations, greatly assisted, of course, by the weathering influences operating in the soil. The principle has the drawback that the amount of labour required to carry it out is large, but against this there are numerous advantages, a few of which may be stated.

The greatest initial effect is better secured by using one large dressing than several small ones in different years. It is like the application of power in moving a weight. One man might use the whole of his strength in attempting to move it without accomplishing anything, whereas ten men might easily do the work in a very short time. So it is with lime. It should be quite possible, theoretically, to repeatedly pepper on to land which requires it lime in a quantity so small that no appreciable initial effect is produced.

Under the method adopted in the present case the grinding of the limestone costs nothing, and is done by natural agencies working in the soil, assisted by the usual ploughing, harrowing, and rolling which the land receives; whereas when limestone is bought already ground a comparatively high price has to be paid for the materials, labour, and fuel used in drying, grinding, and bagging the product.

These notes, of course, only apply where the local conditions favour the method of liming recommended. In all cases where liming is permissible it should, however, be remembered that a large amount of carbonate of lime in the soil will increase the availability of the phosphates, and enable a soil containing a small amount of phosphate to compete with soils richer in phosphate, and so save the farmer's manure bill.

Mr. Rowan's latest report on the experiments, dated 10th November, 1915, and furnished to the Director of the Fields Division, is as follows:—

During the month of August, 1914, I obtained 10 tons of limestone marl from Mr. Chapple's property at Redvale, and distributed it on about 2 acres of land at the Albany experimental plots.

Between three and four years ago these 2 acres were in a virgin state. After the first ploughing and cultivating several varieties of seed were sown, followed by tile draining. The ground was then reploughed and cultivated, and the lime was put on. Rape, Scotch tares, and Algerian oats were sown, and they grew particularly well, with the exception of a strip of land which I left at the bottom of the paddock where no lime was used. The tares and rape on this unlimed portion showed very poor results, although the land itself was the best part of the paddock—the working of the harrows having taken a lot of top soil to it owing to it being situated downhill.

The limed portion of the land appears to have been much improved by the liming, inasmuch as it has become more friable and easier to work.

The lime itself was not ground, there being no machinery for the purpose. It contained many big lumps, which were subsequently broken by the spade and roller, and notwithstanding this rough method of dealing with it it was a success.

It is to be regretted that these deposits are not regularly worked for agricultural purposes by the settlers of the surrounding districts. They are in the midst of the gum-land country, and, being close to water carriage and what is now being made a good metalled road, it should not be a very difficult matter to transport the lime to localities where it is much needed.

BRINGING IN THE CLIP.

STRAWBERRY - CULTURE.

J. W. COLLARD, Orchard Instructor, Whangarei.

THE strawberry can be grown in almost any part of New Zealand, but more attention is paid to its cultivation as a commercial fruit in the Auckland Province, and more especially around Auckland itself, where it is grown to perfection fairly extensively. It is grown fairly well in the South, however, and also in the far North—the Maoris cultivating it with success on the slopes of Parengarenga Harbour.

As a commercial proposition for the newly started orchardist with limited capital, who has several years to wait before his orchard comes into bearing, strawberry-culture is a valuable stand-by. When grown well and the necessary attention paid to the marketing, the strawberry has proved itself a valuable asset. Many costly mistakes, however, are apt to be made by the inexperienced in the growing of this ever-popular berry, right from the initial stages—the selection of the site and the plants—down to the final placing of the fruit upon the market.

The following notes may prove of some interest and use to intending growers—more especially to those who wish to establish a bed on commercial lines.

SITE.

A well-sheltered position should be chosen, one possessing a north-easterly or northerly aspect being preferable. Too steep a slope should be avoided, as a fairly level bed is much easier to work in every way. Good low shelter is necessary immediately around the beds, and this may be provided by black wattle (*Acacia decurrens*) or bottle-brush wattle (*Acacia Lopantha*) well headed back so as to form a compact hedge of from 5 ft. to 6 ft. in height. A well-drained situation is essential, and on no account should the ground be allowed to become waterlogged. The berries are grown well on the ordinary Auckland and North Auckland gum lands; the deep black gum soil of the Auckland District should be avoided if possible in favour of the heavier class of gum soil, upon which the best results are obtained.

PREPARATION.

Too little attention is generally given to the proper preparation of the ground. It should be remembered that this is an all-important question; a well-prepared site is half the battle won. Where it is intended to break up new land this should be done during the autumn, and the ground laid up in rough fallow for twelve months.

As soon as the very early autumn rains in the following season have rendered the soil in a workable condition, the site should be tine-harrowed both ways, cross-ploughed, and subsoiled to a depth of 12 in. to 15 in., then left for a week or so and disked well and tine-harrowed again. In order to obtain an even surface for the bed, which is always desirable, it may be found necessary to hand-rake it over; this also removes any rubbish and lumps of soil that may yet be left on it, and enables the planting to be carried out in a much more expeditious and efficient manner. If the soil is lacking in lime, a dressing at the rate of 15 cwt. to 1 ton per acre should be applied just previous to the disking.

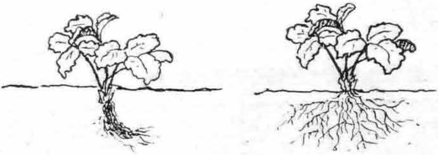


FIG. I.

ON LEFT: STRAWBERRY WRONGLY PLANTED; TOO DEEP, AND ROOTS BUNCHED TOGETHER. ON RIGHT: PROPERLY PLANTED; ROOTS WELL SPREAD.

PLANTING.

In the selection of the plant great care should be exercised as to the strain procured. Runners imported from another district often give the best results, as those obtainable from local sources are in most instances "run out." For instance, runners obtained from the Waikato for planting nearer Auckland often do much better than those obtained from local sources, and *vice versa*. In the choice of varieties the old favourite of Northern growers, the Marguerite, takes a high place as a good grower and cropper; but it is not the best of shippers. Other varieties which do well in the Auckland Province are (in order of merit) Phenomenal, Duke of Edinburgh, and Melba.

The work of planting should be commenced in early autumn, and completed while there is yet some warmth in the soil—*i.e.*, by the end of April. It should be pointed out here that one of the most important objects to aim at is the production of good early spring growth in the plants, and to get good crowns formed up. These are only obtainable by an early-autumn plant, and the production by it of a strong root-system before the cold and wet weather sets in. The simplest method adopted for the planting-out of runners is the furrow system, as follows:—

Take a strong garden-line and put it out to the required position, and with a good hoe make a furrow of from 6 in. to 8 in. deep all along; then distribute a good dusting of blood-and-bone in the furrow, calculated at the rate of 1 cwt. per thousand plants, and fill up again with the soil manured. The plants should then be set out at equal distances of 9 in. to 12 in. apart in the rows, and the rows should be 24 in. or 27 in. from one another. Great care must be exercised in the setting-out of the runners: the record-breaking system of planting a thousand plants a day is not a good one.

The hole to receive each runner should be made separately, and the plant carefully set, care being taken to see that the roots are laid out evenly and straight (see Fig. 1). After replacing the soil around the roots the plants should be pressed in firmly with the first finger and thumb, and the soil surface left even.

CULTIVATION.

Now that the plants are in, work on the beds starts in earnest. They require constant attention. However good plants and soil may be, however favourable the season, or whatever amount of manure may be applied, the plants will never succeed without thorough and continuous cultivation, and this must nearly all be done by hand. Strawberries require to be continually worked around and kept on the move. All weeds should be kept clear. It is a hard problem at times when sorrel appears, but nothing but coat off and perseverance will overcome it. It is advisable to keep the surface of the whole bed broken up, and never to allow it to "pan" down; consequently after heavy rain it is always necessary to get the cultivator to work and stir up the top soil to a depth of 3 in. to 4 in.

For cultivating around and between the plants in the rows, a task that must necessarily be performed by hand, a simple form of home-made hand implement can be easily constructed from a piece

of board about 12 in. long and ¾ in. thick, 2 in. wide at the butt end and tapering so as to form a handle at the opposite end, with four 3-in. wire nails driven through the butt end on the flat and extending in such a manner as to form a miniature hand cultivator. If the points of the nails be slightly bent just at the end it will be found an advantage where weeds are rather thick (Fig. 2).

As regards the work of cultivating between the rows, a very serviceable, cheap, and easily made implement may be constructed from a piece of timber 2½ in. by 2½ in. by about 4 ft. 6 in. in length, fitted at an angle of about 45° to a board 15 in. by 9 in. by 2 in. in thickness so as for form a handle; to the board fix five tines (⅜ in. thick) 1 ft. long, with slightly curved ends, and each made with a foot or three-cornered share at the one end and squared at the opposite end, with the necessary screw-worm and nut for securing, fixed into the board at desired distances, as shown in Fig. 3. This implement may be drawn along the rows, thus allowing the cultivating to be done without again trampling over the work. The depth at which the cultivation is done may be gauged according to the height at which the handle is held, and to what weight is placed upon the board, if so desired.

FIG. 2.
SMALL HAND TOOL FOR CULTIVATING AROUND PLANTS.

During June and July the plants should receive a top dressing of blood-and-bone and superphosphate or basic slag (2 parts blood-and-bone to 1 part superphosphate) at the rate of 1 cwt. per thousand plants, worked lightly in with the small hand cultivator. A light application of kainit at the rate of ½ cwt. to ¾ cwt. per thousand plants, applied in the same manner, is recommended in addition to the above. This should be done a little later as a good top dressing, giving colour both to fruit and foliage.

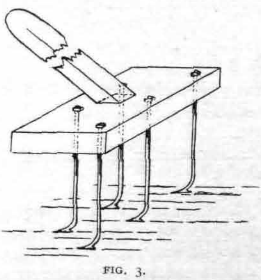


FIG. 3.
IMPLEMENT FOR HAND-CULTIVATING BETWEEN ROWS.

SPRAYING.

Owing to trouble caused by the leaf-spot fungus (*Spaerella frugariae*) in early spring and summer, no time should be lost in getting the Bordeaux mixture applied; the first application (4–4–40) should go on right in the early spring. Or, if desired, the lime-sulphur compound made at 1 part to 80 of water may be used, care being taken to cover the whole plant—the entire surface of the leaf, both on top and beneath. Thenceforward the plants must be kept covered with the spray throughout the season. After the fruit is set the use of lime-sulphur is to be preferred, as it does not mark the fruit like Bordeaux.

PICKING.

There is a great difference between picking and pulling strawberries. On no account when picking for market should the fruit be pulled. Each fruit should be detached from its truss with its stem intact. When pulling is resorted to this not only means the damage to the fruit thus treated, but it also often results in the breaking-off of a whole truss of young fruit or blossoms, or so damages them as to render them incapable of further development.

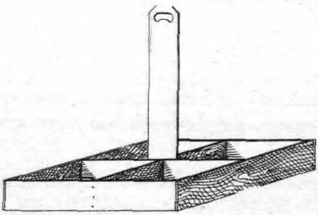


FIG. 4.
PICKING-BOX, TO HOLD FOUR CHIPS.

Time is a great consideration during the picking season, and in order to save the trouble of either going over the beds again or of regrading the fruit the little picking-box shown in Fig. 4 will be found an advantage. This will carry four chips, and enables the picker to grade the fruit as it is gathered. Two of the chips can be used for No. 1 grade, one for No. 2 grade, and one for "jammers." Do not reserve one for "toppers." All the No. 1 grade should be "toppers." Maintain the grade throughout the chips; the result will be a greater demand and higher prices for the fruit.

MAINTENANCE OF BEDS.

The retention of the plants after one season is a matter of choice. Some growers prefer to maintain their plants, and therefore through-

out the fruiting season keep all runners pinched out. On the other hand, some prefer to make up old beds by maintaining the majority of the runners from the parent plant. The system usually adopted under such circumstances is as follows (see Fig. 5): The runners from No. 1 and No. 2 rows are trained and laid over into the intervening space between these two rows. Likewise the runners from No. 3 and No. 4 are trained over to the space between No. 3 and No. 4, thus leaving X as a pathway, and so on. Do not let runners start too soon in the season; neither should the

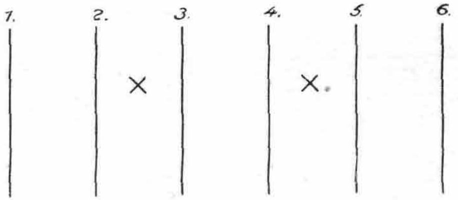


FIG. 5.

SHOWING METHOD OF TRAINING RUNNERS BETWEEN ALTERNATE ROWS.

strings be allowed to run too far at once, as this tends to check the parent plant too severely during the fruiting season. Similarly, too many strings from one plant is detrimental, four being ample.

MULCHING.

Where straw is not obtainable, the plants should be mulched with the next best thing, such as rushes or pine-needles. These should be put down as soon as possible after the first truss has set, and should be carefully laid right up to and under the leaves and trusses on the plant.

A Commonwealth Proclamation, dated 18th November, 1915, declares citrus canker to be a disease affecting plants under the Quarantine Act.

At the Ruakura Farm of Instruction this season 342 acres are under the plough. The total area of the farm, including roads, plantations, &c., is 918 acres.

CULTIVATION.

TILLAGE OPERATIONS AND IMPLEMENTS.

A. McTAGGART, M.S.A., Agriculturist.

AFTER due attention, where necessary, has been given to drainage, liming, and supply of humus (by green-manuring or by a goodly application of farmyard manure), in the order named, the next important factor in the physical treatment of a soil is that of cultivation. This factor is one that is frequently not sufficiently attended to in the growing of crops, especially in districts of congenial climate, where nature is often relied upon too much to produce results. The importance of cultivation cannot be overlooked, not only from the productive standpoint but also from the economic point of view. A soil may be well drained, may contain sufficient lime, and may be provided with the required chemical constituents in sufficient quantity to produce certain crops, yet these may prove a partial, if not a total, failure without sufficient soil-cultivation. Thus expenditure in liming and manures under these conditions will to some extent have proved a loss, cultivation alone here proving to be the limiting factor in the economics of farming.

FUNCTIONS OF CULTIVATION.

Cultivation, or tillage, rests upon three primary objects. These are (1) the modification of the texture and structure of the soil; (2) the disposal of rubbish or other coarse material present on the surface, and the incorporation of manures and fertilizers in the soil; (3) the depositing of seeds and plants in the soil in position for growth.

Under heading (1) the modification of the structure is by far the most important. The structure, or arrangement of soil-particles, can to great advantage be altered very considerably, but the *texture or size of soil-particles cannot be modified to any appreciable extent.* By cultivation operations the structure is altered in such a way that smaller and more numerous aggregates, or *cemented collections, of soil-particles are produced.* This freely admits the air, with its beneficent influences of supplying oxygen and a suitable temperature for the promotion of activity on

the part of the nitrate-forming bacteria. It also partially sweetens the soil, and generally promotes healthy conditions for the active work of beneficial soil organisms and uncongenial environment for the unbeneficial or detrimental life in the soil. By pulverization (altering the structure) of the soil through cultivation its retentiveness for moisture is influenced. Conversely, compaction encourages the movement of water by increasing the surface tension of the soil aggregates. All these beneficent influences react upon the soil solution, thereby enabling the plant to take up its food freely, and so promoting a thrifty crop.

The creation of a soil mulch—or a dust mulch, as it is sometimes called—is simply a change in the structure of the soil at such time and in such manner as will prevent the evaporation of moisture. It is essential, therefore, to appreciate the relation of soil-structure to movement of moisture in managing the mulch. In fine-textured soils, where the granular or crumbly structure is most desired, tillage may have an important influence on the promotion or destruction of these granules. Any treatment which increases the lines of weakness in the soil-structure facilitates the action of the moisture in solidifying the soil-granules. Tillage shatters the soil and breaks it into many small aggregates of particles, which may be further drawn together and loosely cemented by the further evaporation of water.

Thus in the process of solidifying the soil-granules there alternates retention of moisture, encouraged by tillage, with evaporation of moisture, encouraged by the solidifying process. Compaction of the soil by rolling or other means also encourages closer contact of the soil aggregates and increases surface tension, evaporation being thus encouraged by the connecting-up of the moisture film promoted between aggregate and aggregate of soil. Subsequent light surface cultivation breaks this continuity, and for a time evaporation of moisture is checked or minimized and moisture is concentrated at a point in the soil where the young growing plant can make best use of it, usually about 3 in. from the surface.

The timely providing of a "blanket" on the surface of the soil thus conserves moisture; and this is one of the most important points to observe in the growing of crops, especially in districts of none-too-plentiful rainfall. After a shower of rain evaporation is encouraged by the process of solidifying the soil-granules above referred to, and by the increase in the surface tension or continuity of the moisture-film between the aggregates of soil. In this way capillarity, as this movement of soil-water is called, is greatly promoted, especially in the mulched layer, and the passing-off

of moisture goes on apace. If this evaporating moisture is required to promote greater crop-growth, the mulch should as far as possible be renewed by light cultivation as soon after rain as the ground is fit for horses and implement to traverse.

Under heading (2) the burying of rubbish or other coarse surface material is essential for the cleaning of the ground and the provision of congenial conditions for the unhampered establishment and thriving of the crop, as well as for the germination of weed-seeds so that these intruders can as far as possible be subsequently destroyed by cultural operations. The rubbish and coarse vegetation is also converted by decay into humus in the soil.

By cultivation of the soil for (3), the depositing of seeds and plants, a suitable seed-bed is provided—and a fine, firm seed-bed goes far towards promoting the ultimate success of the crop grown. The rule usually followed in providing this is: the finer the seed the finer the seed-bed. Suitable conditions are thereby provided for good germination. The satisfactory seed-bed, together with the subsequent cultivation, where practicable, provides foothold for the crop, and also encourages good root-development. This latter is especially important, for it is by means of its root-system that a plant feeds. Hence, the greater the root-system the greater the feeding-power. The formation of nitrates, encouraged by cultivation, also greatly augments the available or soluble food-supply from which this root-system can draw. The cultural operations also distribute the manure well through the soil, thereby encouraging the greater development of root-system.

In addition to these three primary functions of cultivation are the secondary, as follows :—

(*a*.) Preparing the soil for the subsequent growth of a diversity of crops. Systematic tillage promotes the production of more available plant-food. It also encourages the accumulation of nitrogen by leguminous crops (provided they are expressly grown), and by certain non-symbiotic bacteria—that is, those few soil organisms that have the power of extracting nitrogen from the air without the association of leguminous crops.

(*b*.) Conserving fertility, by causing fodder crops to take up plant-food that in portion would otherwise tend to leach or wash into the subsoil or drainage waters.

(*c*.) If systematically conducted, reducing the wear-and-tear on farm machinery and the power necessary for draught, by promoting ease of working of the soil, thereby making for farm economy.

TILLAGE IMPLEMENTS AND OPERATIONS.

The plough is the most important tillage implement on the farm. Indeed, ploughing is the basis of successful agricultural farming. Of all tillage implements the plough is the best granulator, but if the land is ploughed when too moist we are liable to get a clogged soil. It is, indeed, a mistake to work with any implement when the land is too wet. The action of the plough embodies three operations in the granulation of the soil. These are—The lifting effect of the share; friction of the furrow-slice against the plough; the effect of the twisting of the mouldboard.

Mouldboards may be of three main types:—

Sharp: the deeper the ploughing the sharper the turn of the mouldboard required.

For general ploughing a medium-turned mouldboard is used.

For skim-ploughing or for sod, where the turning is desired to be done as easily as possible, a long comparatively straight mouldboard is used. A plough of this description, for turning as upright a furrow as possible, is also best suited for ploughing-under green manure or rubbish, the reason being that by its use the green material is buried without being completely reversed, in which position the decaying vegetation does not interfere with capillarity, or the natural flow upwards of soil-water. The operation is rendered more effective by attaching a heavy chain to the beam of the plough.

Subsoil Ploughs.—Apart from modifications in plough-construction due to the above conditions, there are ploughs which have been designed for special conditions. There are subsoil ploughs for loosening-up the hard pan formed, in clay soils particularly, as the result of ploughing continuously at the one depth and by the feet of horses. These ploughs are short and without mouldboards, and possess long narrow shares either for breaking and raising the subsoil or for breaking through it. Later developments in subsoiling implements embrace the use of special attachments of New Zealand manufacture on either single- or double-furrow ploughs. On comparatively small areas subsoiling may be effected by making use of a single-furrow plough, with mouldboard removed, in the furrow produced by a full-mantled implement. Such practice is recommended for loosening-up the subsoil for the growth of lucerne, provided the hard formation is not too solid nor too deep.

The hillside plough is a modified form of the ordinary single-mouldboard plough, but has a double curvature to the mouldboard,

so that it is essentially two ploughs in one. The mouldboard swings on a swivel in such a way that it may be locked on either the right or the left side, to permit the furrow being thrown downwards, and not "against the hand," whichever direction the team is following along the contour of the hill.

The disk plough is essentially a large revolving disk set at such an angle that it cuts off and inverts the soil, at the same time pulverizing it quite effectively after much the same manner as the mouldboard plough. One advantage claimed for it is its lighter draught for the equivalent in work done, because it has rolling friction in the soil instead of sliding friction. In practice, it appears to be especially effective on very dry, hard soil and in turning-under rubbish. For stubble land and open soils generally it also gives good results.

Other ploughs include the following: The digger plough, for pulverizing the furrow-slice, thereby making the most of the ploughing operation, and for raising or deepening the "staple" of the soil. This plough is specially desirable on comparatively shallow soils in districts of high rainfall, also in dry districts. The stump-jump plough is a two-furrowed plough with collapsible legs which permit the plough to ride over a stump when encountered. This plough is suitable for ploughing between stumps, provided they are not too numerous. The swamp plough is a large and heavy single-furrow implement capable of reverting a furrow of broad dimensions, and burying rushes and other coarse swamp growth. It is suitable for use only where the soil is deep or reasonably so, and where there is not too much swamp wood encountered. In the deep swamp soils of Southland and in parts of the North Island this is a plough that has given excellent results.

Depth of Ploughing.—The depth to which ordinary farm lands should be ploughed is a question often raised. This depends upon the nature of the soil, and to some extent upon the climate. Deep ploughing is greatly to be recommended as a practice increasing the moisture-holding capacity of the soil, particularly where organic matter (humus) is well supplied. It creates a deep soil, and should establish the best conditions for the storage of moisture, as well as food for the plant. If organic matter is not well supplied, either naturally or artificially, deep ploughing is not advisable on light sandy soil; but on clay soil it is beneficial because of the loosening or granulating effect. Deep ploughing in the autumn or early winter, and shallower in the spring, is a practice that has been found by experience to greatly benefit the crop following, largely because of the extra moisture conserved thereby for use by the plant. For this same reason,

and that of the pulverizing action of frost, wheat does better grown on land ploughed and let lie all or a part of winter than on soil seeded soon after the first ploughing.

Subsoiling loosens-up the structure of the deep subsoil, increases the ease of root-penetration, the rate and depth of water-percolation, and on clay soil it increases the water-holding capacity. Subsoiling in the autumn, although usually more difficult to accomplish, is more likely to result in benefit than if performed in the spring. A "hard pan" layer below the plough depth may seriously interfere with the upward movement of water and the penetration of roots. This condition may be largely corrected by subsoiling. Ploughing continuously at the same depth may, as already indicated, bring about this "hard pan" condition. To eliminate this possibility the aim in ploughing should be to go a shade deeper each time, within the range of the depth of the soil.

From the point of view of climate deep ploughing is permissible in a dry climate, more especially if the soil is well supplied with humus, and in a wet climate shallower ploughing is the rule to observe. Where the soil is of a sandy nature in a wet climate reasonably deep ploughing is permissible.

The Disk Harrow.—Next to the plough the most useful implement in the promotion of good tilth is the disk harrow. For heavy and refractory soils, such as clays, clay loams, drained swamp soils, and strong loams, the disk is especially useful in forming good fine seed-beds. The heavier and more refractory the soil the heavier the disk that is required. The disk with plenty of bias or dish is the better implement to use. Greater use should be made of this agency in the promotion of soils possessing tilth. For orchard work the extension disk is a useful implement, for it enables cultivation to be carried out close in under the branches of the fruit-trees.

Cultivators.—For the destruction of weeds, in addition to the thorough amelioration of the soil, the spring-tooth cultivator is an implement that is hard to beat. For conserving moisture during a dry summer, in the event of late crops such as turnips or rape being seeded subsequently, light cultivations with this scarifier will frequently produce highly satisfactory results.

Where specially refractory clay or other soils are encountered, bringing them into a state of tilth is greatly facilitated by use of the heavy-tined cultivator or grubber. This implement tears asunder the heavy soil and stiff lower-surface soil, and generally

accomplishes what cannot be accomplished by a disk. More horse-power is, of course, required in its use than with the disk.

For the cultivation of maize special cultivators are on the market. This is a crop that specially responds to cultivation. Indeed, in a dry season a good cultivation of maize is about equal to a shower of rain, on account of the moisture conserved. As a rule, several good cultivations during the season will suffice in this country. These should be carried out as soon after a shower of rain as possible, for the purpose of conserving the moisture that has fallen. When the young maize is a few inches to about a foot high deep cultivation is permissible, but after this the depth of cultivation should be lessened as the growth proceeds. This is for the purpose of eliminating the danger of cutting the secondary roots that develop as the crop grows.

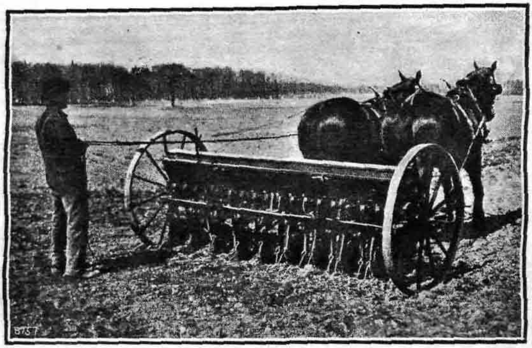
Drilled root crops should all as far as possible be cultivated with the horse-hoe in order to destroy weeds, to conserve moisture, and to generally render available plant-food for the continuous development of the crop. The systematic cultivation of drilled crops in certain districts is often neglected, nature being left to produce a crop after the land has been worked and the seed sown. Certainly the labour question enters in; but in spite of this difficulty the economic loss from the growing of root crops under these conditions must be clear to all. Of course, root crops such as turnips and swedes can be broadcasted; but even here unless the soil has been systematically cleaned by thorough cultivation loss must surely ensue.

Tine and other Harrows.—In the providing of perfect tilth and a fine seed-bed nothing beats a good set of tine harrows. In mellowing the soil it has no equal. For conserving moisture by providing and maintaining a mulch on the surface of a tilled field which is to be used subsequently for crop-production the periodic use of the tine harrows, especially after showers of rain, has a marked effect upon the crop seeded later. For covering grass-seed sown on a well-compacted seed-bed the chain harrow is very useful. As a substitute a home-made brush harrow can be used to advantage.

Cultivation of Pastures.—To scatter droppings on grass land in winter or early spring, and to break the crust of the ground, also to drag out the moss, the chain harrow is again of value. A light tripod harrow is even better for securing these effects; and, failing its use, tine harrows turned upside down can be used to advantage. The cultivation of pastures for the purposes named and for the aeration of the soil is well worthy of attention—com-

patibly with the farm labour available. The grass crop—the staple crop of New Zealand—has a claim to be cultivated, where practicable, in keeping with other farm crops.

The Cambridge roller is an implement especially valuable for compacting soils, especially those of light and open nature. By compaction it brings the soil aggregates closer together, thereby increasing surface tension and hence capillarity. It thus encourages the water to come up naturally from below. But as capillarity proceeds apace, so does evaporation as the result of rolling. A light mulch on the surface of compacted soil, produced by a stroke



DOUBLE-DISK DRILL.

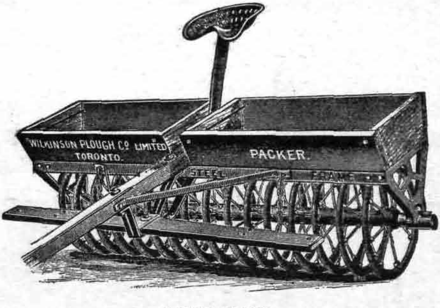
An 18-disk drill worked by two good horses on a well-cultivated farm.

of the chain or brush harrows, will tend to check that evaporation, and so direct the increased capillary water towards the roots of the young growing seed or plants. Rolling also gives firm foothold to crops and evens the ground-surface, thus providing in the case of the grass crop an even sward. In the laying-down of pastures a fine firm seed-bed should be provided by rolling, after disking and harrowing, and the seed mixture finally lightly covered by means of a chain or brush harrow. In the drier districts deeper covering could be provided by light tine harrows. In sowing lucerne and clover seeds, rolling before and after seeding, with final chain- or brush-harrowing, is desirable.

The Double-disk Drill.—In dry and comparatively dry districts where cereal crops, especially wheat, are sown, best results will be obtained from the use of the double-disk drill. The seed falls into place between the disks, and these pack the soil well around the grain, thereby enabling it to take full advantage of whatever little moisture is present in the soil. The writer has observed the excellent results produced by this type of drill in a land of comparatively low rainfall—Western Canada—and can testify to its superiority over the single-disk and hoe drills for comparatively dry-land conditions.

DRY-LAND IMPLEMENTS AND CULTIVATION.

For cultivation operations in districts of low or comparatively low rainfall, as, for instance, Central Otago, the use of dry-land

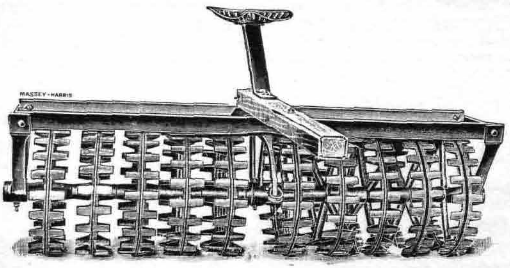


SUBSOIL PACKER.
The boxes are for weighting-material.

implements is well worthy of consideration. Such implements are the *subsoil* and *subsurface packers*, machines which play an important part in the conservation of moisture, hence productive farming, in Western Canada and the United States. In specially dry districts there the subsoil packer is used in conjunction with the subsurface packer, while in localities of more (though not sufficient) rainfall, the subsurface packer alone is used. The subsoil packer is really an exaggerated Cambridge roller, consisting of sharp separate wheel sections which penetrate to the lower layers of the surface soil and

by compaction bring moisture from below to the roots of the crop. This implement is used in carefully preparing a seed-bed for a crop like lucerne, and wheat or grass grown in dry districts; or it may be used in the growing crop up to a certain stage.

The subsurface packer is a roller built like the Cambridge, in sections, but with sections of the flattening-surface systematically cut away. It packs the soil immediately below the surface layer and provides a fine mulch which tends to check the evaporation of the moisture encouraged to flow upwards by capillarity. The subsurface packer, then, completes the good work of the subsoil packer. It also promotes the decay of vegetable and animal matter, and assists plant roots in penetrating into the subsoil below, where they



SUBSURFACE PACKER.

may have a larger moisture and food-supply. Coupled with deep ploughing and subsoiling, subsurface packing is also beneficial. Particularly is this true in early autumn and late spring ploughing in dry districts, where the soil is likely to be cloddy and to make poor capillary contact with the subsoil. Spring crops may be greatly injured by this condition. The subsurface packer crushes the clods, presses the furrow-slice down more firmly on the subsoil without compacting the surface soil. It leaves the light mulch on the top to hold the moisture.

The beneficial results obtained in cultivating dry lands in North America lead me to the opinion that these implements have a place in the cultivation operations practised in the dry and comparatively dry areas of this country. Certainly they are more adapted

for such climates than are certain of the implements at present in use, implements good in themselves but used on the whole throughout New Zealand irrespective of our great variations in climatic conditions.

A PLEA FOR MORE ADAPTIVE METHODS.

Apart from the system advocated of "building" lighter and poorer soils by green-manuring (compatibly with productive operations), the writer questions whether the farmers of this country adapt themselves sufficiently to meet the varying seasonal and climatic conditions of New Zealand. For instance, when a dry season is experienced in a definite locality the system of cultivation should change accordingly. Crops grown on land that has cost the farmer a good deal in preparing the ground, and for manures and seed, should be as far as possible systematically cultivated for the conservation of moisture. Even the tine-harrowing of the young grain crop or of the young turnip crop will form a mulch for purposes of checking evaporation; and it is surprising what a little extra moisture will do in a dry season. The use of the packing-implements above referred to for preparing seed-beds in such a season is well worth consideration by the farmer. So also in prevailingly dry districts these implements could always be used by farmers in preparing the land, and more timely cultivation carried out. In such districts turnips should not be sown on ridges, as frequently is the case; but rather should the practice prevail only in districts of high rainfall.

The point it is desired to convey is that our dry districts (whether prevailingly or seasonably) should as far as possible adopt a modified system of dry farming. Even with irrigation dry-farming methods are advisable. In these districts also a fairly liberal use of soluble phosphates should be made, to promote root-development and to thereby enable the crop to search for moisture. Systematic or reasonable cultivation should also be adopted in districts where nature is kind, in order to destroy weeds and compensate the farmer, by good crops, for the money and labour expended in seeding them.

These are a few of the lines along which we as farmers can became more adaptive to our climatic and other environment. Our chief consideration should be that of practising systems of cultivation more suited to variations in climate and season. Independently of the labour problem, I claim that this can be carried out to an appreciable extent.

PRICKING OF HORSE'S FOOT.

J. G. CLAYTON, M.R.C.V.S., Senior Veterinarian.

A CORRESPONDENT states that he has a horse that has been "pricked" in shoeing, and desires information regarding the best method of treating such cases.

If it is known that the foot has been pricked, all that has to be done is to run a little tincture of iodine down the nail-hole, and everything will probably go well. The real trouble is in cases when one is not aware that pricking has occurred. Often the first indication (apart from lameness) is the appearance of pus at the coronet. Pricking a horse really consists of driving the nail into the sensitive structures of the foot instead of through the insensible horny wall. The mischief resulting is not due so much to the actual injury done to the sensitive parts by the penetration of the nail as it is to the fact that the nail has carried into the foot dirt containing pus- or matter-forming micro-organisms. The sensitive horn is elastic and springy, and when the nail is withdrawn the small orifice made closes, leaving the dirt, organisms, &c., imprisoned behind, when the formation of matter immediately begins.

In the majority of cases the pricking is done by what is called a "draw-back." While knocking on the shoe a nail is directed in the ordinary way and driven a certain distance, when it is necessary to drive cautiously, the smith being mainly guided by the sound that his nail is going right. If it is not right he draws the nail back. Here he should apply the tincture of iodine, which, being spirituous, will penetrate right to the bottom of the nail-hole, and he should leave the nail out of that part of the foot until next shoeing. A careless smith, however, will say nothing about the occurrence, but will go on and finish the shoeing, although he cannot tell how far his nail penetrated the sensitive foot.

In such a case the horse may walk away from the smithy all right, and may even work for a couple of days, when he is found to be slightly lame, the lameness gradually increasing until the animal cannot bear to put any weight on the leg. The foot may or may not be hot, but if the hoof is tapped with a hammer the horse shows more or less evidence of pain. The shoe should

be removed, taking care to examine each nail as it is withdrawn in order to see if there is any discoloration or evidence of matter. The foot may now be tried round with the pincers, applying gentle pressure in order to ascertain any particular part where the squeezing causes pain. Having located the part, the horn around the nail-hole should be removed to the bottom and the matter liberated. This is usually dark-coloured and evil-smelling.

At other times it is not so easy to find the matter. In such case every hole should be examined, and every dark-coloured stain in the horn pared out to the bottom. A narrow thin-bladed knife called a "searcher" should be employed for this work. The opening should be made as large as possible, to allow exit of the pus. In opening for the first time the parts may bleed a bit, so that the operator cannot see clearly what he is doing. After poulticing for a few hours, however, this condition clears up and the hole can be made large enough without trouble. It is a good plan, after the matter is liberated, to put the foot into a bucket of hot water for an hour, adding a little disinfectant. Afterwards apply a bran poultice for a couple of days, changing the poultice three times a day. The lameness should have improved by this time; if so, wash and dry the foot and pour a little tincture of iodine into the hole, stuffing it with tow. Tie a piece of dry sacking round the hoof to keep the dirt out. If everything goes on well the horse should be fit to work in two or three days. For the first shoeing it may perhaps be best to put on a leather sole, packing the sole with tar and tow.

It does not always follow that because a horse has matter in his foot the trouble is due to shoeing. Indeed, probably in half such cases there has never been any pricking at all, the cause of the trouble being the working-up of grit or gravel through a crack in the horny wall or an old nail-hole. This material works up until it reaches the sensitive part, setting up the formation of matter in the same way as the dirt from the nail. It is not uncommon to find horses which have never had a shoe on in their lives suffering in this manner. In these cases the matter must be given exit as with the prick, by paring out the horn, &c., at the bottom of the foot where the crack is located, the subsequent treatment being the same. It is of the utmost importance in all cases of matter in the foot that a dependent opening be made for it, otherwise it will work up the sensitive laminæ and escape at the coronet, the result being a quittor (chronic abscess), which it is often a difficult and lengthy process to cure.

WEEDS AND THEIR IDENTIFICATION.

CONTINUED.

ESMOND ATKINSON, Biological Assistant.

Capeweed (*Cryptostemma calendulaceum*).
Hawkweed (*Crepis capillaris*).
Hawkbit (*Leontodon hirtus*).

In the present article of this series the writer deals with the three remaining weeds of the group set forth in the August issue of the *Journal*. As these three plants have many features in common with the two already described (catsear and dandelion), the descriptions will not be so detailed, and it will be sufficient in most cases merely to point out the principal differences that exist.

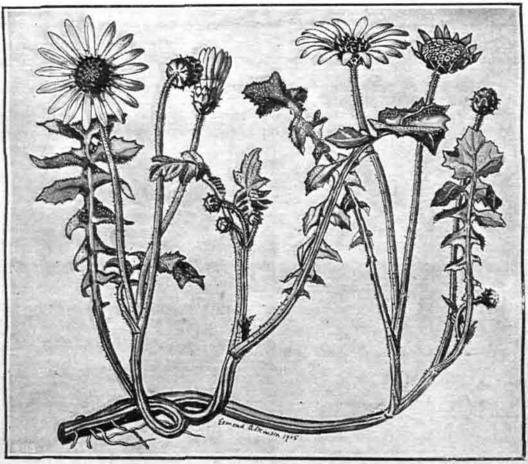


FIG. 1. PLANT OF CAPEWEED, ABOUT HALF NATURAL SIZE.

CAPEWEED.

General Description.—Capeweed is a perennial herb with prostrate stems from which arise the leaves and flower-stalks. The plant varies considerably in appearance according to habitat. In poor soil it forms spreading patches only a few inches high, while in rich ground it may reach the height of 1 ft. or 18 in. The leaves are up to 6 in. or so in length, green and rough with short hairs above, while below, except for the naked midrib and veins, they are covered with a thin whitish cottony felt (tomentum). The leaves are deeply and irregularly cut and lobed, and in outline are not unlike those of the dandelion. The flower-stalks are solitary or arise several together from the stems, each bearing a single flower-head. No detailed description of the latter is necessary, as they cannot possibly be confused with those of any other weed found in New Zealand. The centre, or disk, is very deep purple or almost black in colour, and is surrounded by spreading pale-yellow rays.

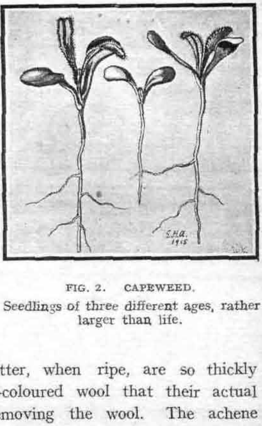


FIG. 2. CAPEWEED.
Seedlings of three different ages, rather larger than life.

The seed-heads are as distinctive as the flowers. When the flower fades the ovoid head droops slightly, but when the fruit is ripe it becomes upright again, and the involucral bracts spread apart and show the mass of achenes (see Fig. 1). The latter, when ripe, are so thickly felted with long purplish or fawn-coloured wool that their actual shape cannot be seen without removing the wool. The achene itself is roughly top-shaped, but is contracted at the upper end, which forms a disk bearing the scale-like pappus round its rim. The body of the achene has two strongly marked longitudinal ribs dividing it into two faces, of which one is slightly more flattened than the other. Both faces are transversely wrinkled, and are of a brownish colour. The achene averages about $\frac{1}{8}$ in. in length.

Seedling.—The two seed-leaves, or cotyledons, of capeweed are not unlike those of dandelion, but are more obtuse, besides being considerably thicker and more fleshy than those of any of the other

four plants under consideration. The next leaves are covered with scattered whitish hairs above, and below, except for the well-marked midrib, show the white tomentum characteristic of the leaves of the mature plant. The margins of the later leaves of the seedling are obviously toothed and indented. The white under-surfaces of the leaves which appear after the cotyledons at once distinguish this seedling from those of catsear, hawkweed, dandelion, and hawkbit.

Distribution.—Capeweed is chiefly found in the North Island. In the South it has been recorded from Heathcote, near Christchurch, and at Westport, but as the weed is undoubtedly spreading it is probably found in other places as well. In the North Island capeweed is abundant in many parts of the country, though so far it is comparatively rare in the neighbourhood of Wellington.

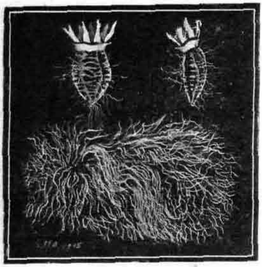


FIG. 3. ACHENES OF CAPEWEED.
Two above with wool removed.
Magnified 6 times.

I am indebted to Mr. J. W. Deem, Fields Supervisor, Wanganui, for the following information regarding capeweed. He says, "As a rule capeweed is confined to roadsides and such waste places, but in some of the lighter lands round Wanganui settlers complain that it is getting into their pastures. It has a strong hold in this district, particularly in sheep and cattle accommodation paddocks, where it is often very luxuriant. Under ordinary conditions stock do not appear to eat it, but where big mobs of hungry sheep are put into these accommodation paddocks they quickly eat it up and there are no apparent bad effects. From my observations I do not think the plant is likely to do much harm, if any, on lands carrying a good sole of grass, but on bare pastures and accommodation paddocks it will take possession, and although these plants in such places may be eaten bare and kept in that state for several months in the summer, it is only necessary to give the land a spell about May and they will come up as thick as ever. While I do not think it will do much harm to pasture lands on this coast, I would say that it is not a desirable addition to our field plants."

HAWKWEED.

General Description.—The plant with which hawkweed is most likely to be confused is dandelion, though it is only in the absence of flowers that any mistakes can be made.

Till the flowering stage both plants have similar rosettes of radical leaves, with the difference that the leaves of hawkweed

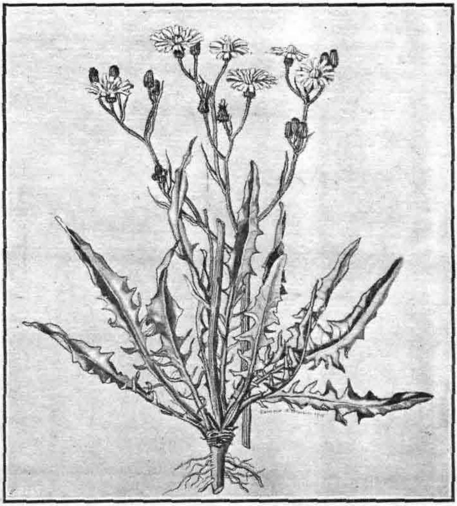


FIG. 4. PLANT OF HAWKWEED, RATHER LESS THAN HALF NATURAL SIZE.

are smaller and narrower, and often (though not always) cut into finer segments towards the base. Directly the flower-stalks appear, however, there is no possibility of confusion. The flower-heads of hawkweed, instead of being solitary as are those of dandelion, are borne on a tall, much-branched, and leafy stem. Fig. 4 will show better than a description the general appearance of the plant.

After flowering the involucre forms a cone, but as the achenes ripen and the pappus of each spreads out the head becomes roughly globular and about $\frac{1}{2}$ in. or so in diameter. The achenes are about $\frac{1}{10}$ in. long, brown in colour, oblong in shape, but tapering towards each end. They are often more or less curved, and the surface is marked with from ten to fourteen longitudinal ridges. The pappus is borne on a rim at the top of the achene. The pappus-hairs are snow-white, and when magnified each hair is seen to be clothed with very short bristles.

Seedling.—The seedling is very like that of dandelion, but the seed-leaves, or cotyledons, are much broader and rounder, and the

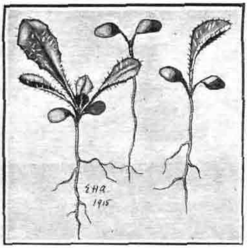


FIG. 5. HAWKWEED.
Seedlings of three different ages.
Rather larger than life.

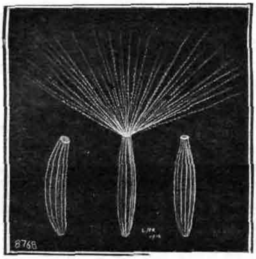


FIG. 6. ACHENES OF HAWKWEED.
Magnified 6 times.

leaves that follow are usually paler green and more delicate-looking than those of dandelion. All the young leaves except the cotyledons are clothed with scattered hairs, whereas the seedling of dandelion is glabrous. Another distinction in slightly older seedlings is that the leaves of hawkweed taper more gradually into the leaf-stalks, and the marginal teeth are not so obviously directed towards the base of the leaf.

Distribution.—The distribution of hawkweed is much the same as that of dandelion, but, since it is only an annual or biennial, hawkweed is not nearly so difficult to deal with.

The achenes are common impurities in many agricultural seeds.

HAWKBIT.

General Description.—Hawkbit in general appearance is very like catsear, but there are several conspicuous differences. The leaves are smaller, more acutely pointed, narrower in proportion to their length, and do not taper from apex to base so noticeably as those of catsear.

The leaves of both plants are very variable in the extent to which they are lobed, but in hawkbit the lobes are not generally so twisted and the indentations are more uniform in any individual leaf.

FIG. 7. PLANT OF HAWKBIT, ABOUT HALF NATURAL SIZE.

The flower-heads of the two plants are very similar, though those of hawkbit are smaller, but the stalks on which they are borne are quite different, since in the case of hawkbit they are usually very hairy, and are never branched. The buds of hawkbit are very characteristic. The tips of the flower-stalks are gracefully curved back until shortly before the heads expand, when the drooping buds are raised and the stalks straighten. The head of ripe achenes is very like that of catsear, but is usually less than half the size, and brownish, not white, in colour. The achenes are of two kinds. Those resulting from the fertilization of the

innermost florets of the head are not unlike the achenes of catsear, but they are slightly smaller and more flattened, very shortly beaked, and the teeth on the longitudinal ridges are much more strongly marked. The pappus is yellowish brown, and the radiating hairs which comprise it are themselves clothed with both short and long hairs.

When the seed-head, or "clock," has been dispersed by the wind and apparently nothing remains of the head but the recurved involucral bracts, a close examination will reveal the presence of a ring of achenes lying close against the ring of bracts and

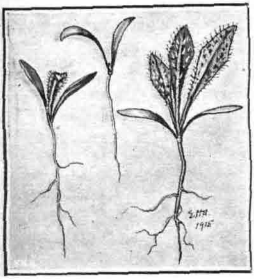


FIG. 8. HAWKBIT.
Seedlings of three different ages. Rather larger than life.

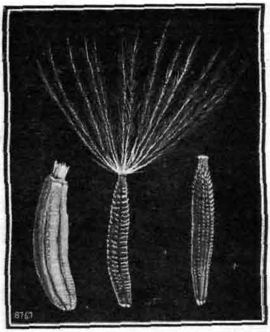


FIG. 9. ACHENES OF HAWKBIT.
Outer one on left. Magnified 6 times.

recurved with them. These achenes are quite unlike those of the central florets, the pappus being reduced to a scaly crown, the achenes being shorter, stouter, and paler in colour, and without the strongly toothed ridges of the other type.

The achenes are occasionally found as impurities in agricultural seeds.

Seedling.—The seedling is very similar to that of catsear, and as a rule can only be distinguished by the leaves which follow the cotyledons being much narrower and more pointed.

Distribution.—Hawkbit is fairly commonly distributed throughout New Zealand. It is not of great economic importance, and is

chiefly found on roadsides, &c., particularly in sandy localities. It is included here on account of its similarity to the very important weed catsear. Another species of hawkbit (*L. hispidus*) is also found in many parts of the country, and may be confused with this species, but it is not necessary to distinguish the two plants, as they are very similar and occupy much the same position as weeds.

NOTE.—The next article of this series will deal with six of the commonest thistles found in New Zealand—viz., Californian thistle (*Cnicus arvensis*), winged thistle (*Carduus pycnocephalus*), spear thistle (*C. lanceolatus*), nodding thistle (*C. nutans*), woolly thistle (*C. eriophorus*), and milk thistle (*Silybum Marianum*).

IMPROVING FARM IMPLEMENTS.

G. DE S. BAYLIS, Fields Instructor.

SPEAKING generally, our soils and crops require more cultivation than they usually get. It is desirable that this cultivation should be accomplished so far as possible without seriously increasing the time occupied in the work or the cost of production. Cultivation is largely a question of labour, which is scarce and costly. The solution of the labour problem lies in great part in supplanting more of the manual labour by machinery. The cost of cultivation could be much decreased by improved implements, or by contriving special attachments to implements already in use, enabling one man and a team to accomplish more at one operation than they do at present.

The agricultural and pastoral associations, farmers' unions, and other such bodies might with advantage periodically discuss the subject, and later appoint a select committee to consider all proposals put forward, with a view to giving a lead in the right direction to implement-manufacturers, who are often indisposed to do much pioneering work without some indication of support.

Many farmers have good mechanical ideas, but have not the time to develop them, and are sceptical as to whether the somewhat lengthy and expensive process of taking out a patent would ultimately repay them; hence many a valuable idea is lost. As an example of such mechanical "notions" I may mention one case

that came under my notice. A farmer ploughing heavy clay with a disk plough found that his soil after ploughing speedily baked, and became impossible to break down unless worked very soon after ploughing. The labour available consisted of himself and a team. It was often necessary to stop ploughing and start disking. He had a few blades of a broken disk; these he contrived to attach to the disk plough in such a manner that the sod on falling was cut into pieces, leaving the paddock very much as if it had received one disking. One extra horse in the team was sufficient for the work.

If practical farmers were brought into direct touch with the implement-manufacturers by a well-organized method, perhaps somewhat on the lines suggested, I believe that results would finally be obtained which would be satisfactory both to the manufacturers and to the agricultural community.

SWEET CLOVER (MELILOTUS ALBA).

A NOTE on sweet clover by the writer was published in the *Journal* of May last. Since then I have had the opportunity of observing a field of about 2 acres of the clover growing on Mr. E. Griffiths's property at Bell Block, Taranaki, also of noting the manner in which it was treated by stock. During the winter the *Melilotus alba* made very little growth; in fact, at one time it looked as if the weeds would choke it out. In the spring, however, it recovered, quite beating the weeds, which by the end of November could not be seen owing to its luxuriant growth. For bulk of fodder it beat any crop of lucerne in the district, and appeared much more hardy. While all the lucerne crops I saw about were showing the effects of wind and rain, this field of sweet clover showed none. Having had permission to cut some of the clover, I gave one or two bundles of it at the end of November to a Jersey cow and some young cattle, also to two horses, all of which ate it with the greatest relish. Owing to certain circumstances, the crop was left rather late before general cutting, and became very coarse in the stem.

The results were certainly satisfactory so far as they went, but before giving a definite opinion as to the suitability or otherwise of *Melilotus alba* as a fodder plant to cultivate further trials are needed.—*R. E. Fairfax-Cholmeley, Fields Inspector, New Plymouth.*

GUERNSEYS.

W. M. SINGLETON, Assistant Director, Dairy Division.

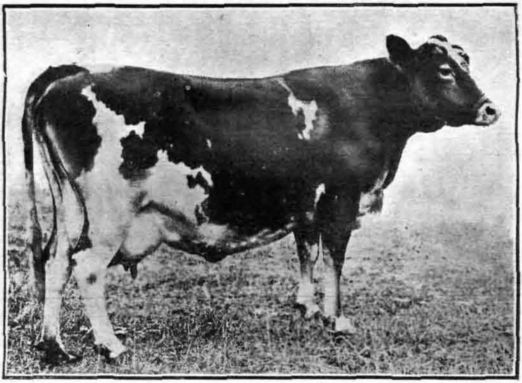
THE Guernsey as a special-purpose dairy breed ranks amongst the very foremost. It is rather surprising to visitors to New Zealand that the sole representatives of this breed in this Dominion are contained in three herds. These are owned by Messrs. G. Gould, Christchurch; H. S. S. Kyle, Sockburn; and L. Wilson, Teddington.

In her native island of Guernsey, and in England, Australia, Canada, and the United States, the Guernsey cow is looked on with much favour. More particularly is this the case in her home land and in North America. Good breeders have developed the excellent features of this race, and by show contests and yearly yields have shown the Guernsey to be equal to any other breed as an economical producer of butter-fat.

Individual Guernseys have evidenced remarkable capacity in yielding large quantities of butter-fat. For some time the world's record production for one year was held by a Friesian—Banostine Belle de Kol—a cow that produced in a twelve-month 1,058 lb. fat. The laurels were wrested from this cow by a Guernsey named May Rilma, with a yield of 1,073 lb. fat in 365 days. In a short time May Rilma had to strike her colours to another Guernsey, Murne Cowan, with a production of 1,098 lb. fat in a year. Although this yield has since been exceeded by a Friesian, it is unlikely the last word has been heard from the Guernsey.

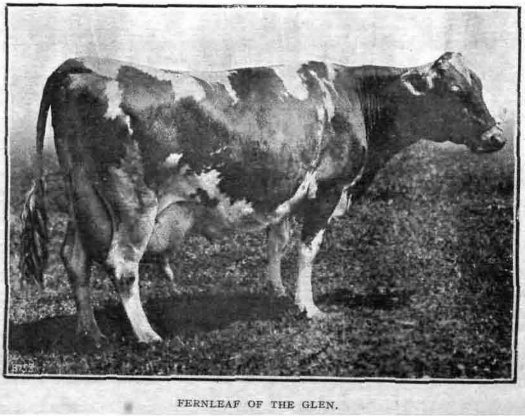
In the United States of America some 4,298 Guernseys have qualified on yearly production. This number includes all ages. The average production of 1,275 cows in the mature class is 10,065 lb. milk, containing 495 lb. fat. The average cow of all classes is credited with 8,752 lb. milk, containing 437 lb. fat. In Guernsey Island the yearly test has been adopted and some very good results recorded.

The Guernsey has many of the characteristic features of the Jersey. Indeed, it is maintained by some historians that they came from the same original stock, but that the Guernseys represented the selections from the larger and less refined-looking parent stock. The percentage of fat in the milk of the two breeds is similar, but the fat in Guernsey milk has a more pronounced yellow tint than the milk of any other breed.

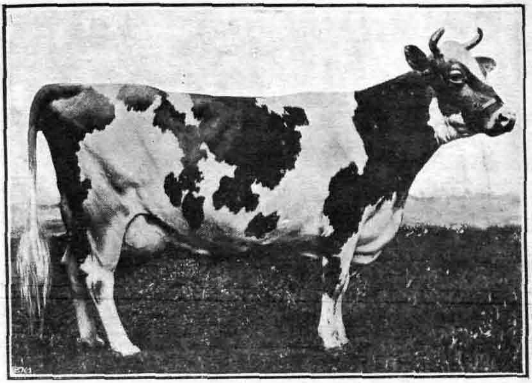


DAIRYMAID OF PINEHURST.

Guernsey champion senior four-year-old, with record of 17,285·30 lb. milk, 910·67 lb. fat. One-time holder of world's champion three-year-old record of all breeds, 860·26 lb. fat.

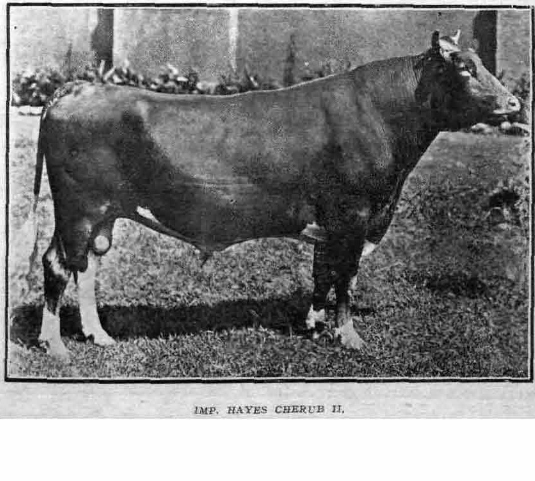


FERNLEAF OF THE GLEN.



GLENCOE'S BOPEEP.

A noted show champion in the United States. Year's record, 13,121·70 lb. milk, 622·61 lb. fat.



IMP. HAYES CHERUB II.

It is probable next decade will see the Guernseys represented in New Zealand in much larger numbers. The merits of the breed cannot be passed over lightly, and more especially is this the case in butter-producing districts.

ILLUSTRATIONS OF AMERICAN GUERNSEYS.

The Guernsey cattle shown in the illustrations on pages 42 and 43 are representatives of the herds of Mr. W. W. Marsh, of Waterloo, Iowa, U.S.A. The photographs were supplied by Mr. A. Macpherson, Fields Instructor for the South Island, who recently returned from America. Mr. Macpherson writes, "Mr. Marsh owns fifteen dairy farms around Waterloo, on which he keeps only pure-bred Guernseys, and his herds are reputed to be the finest of this breed in the United States. Mr. Marsh invited me to visit his farms and inspect his herds while in the States. This I did, and was much impressed with the splendid specimens of this famous dairy breed comprising his large herds, exhibiting throughout animals of great constitution and quality, and having great milk, butter-fat, and show records. The photographs are of animals that I saw on the farms, and were taken after my visit."

ENSILAGE.

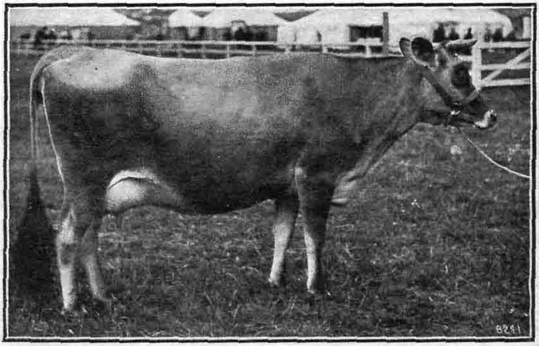
THERE are few districts where there is not a certain season of the year in which the farmer looks back with envy to the time, some weeks back, when abundant crops were growing in his paddocks, and contrasts the then plenty with the scarcity during the dry summer or cold winter. The ensilage stack and the silo offer not only a chance of profitably using these abundant growths, but are also an insurance against scarcity. In districts subject to early droughts such crops as oats and vetches can be autumn-sown, and, while providing a certain amount of grazing in winter, can be cut early before the dry spell starts and made into ensilage. In this way artificial feed is secured should early drought cause the failure of spring-sown crops. If not required at once, ensilage will always keep, provided it is properly made. Spring-sown crops of maize, millet, sorghum, Italian rye-grass, oats, vetches, barley, peas, &c., are all suitable for ensilage. The growing of crops for ensilage and the making of ensilage should appeal to farmers where the climate is not very suitable for haymaking, as well as to those in districts subject to drought, as a means of storing up during the season plenty of succulent food for use when the paddocks are

CERTIFICATE-OF-RECORD TESTING.

STRIKING PERFORMANCE OF A NEW ZEALAND JERSEY.

W. M. SINGLETON, Assistant Director, Dairy Division.

THE name of the cow here pictured is well known to dairymen who are readers of the *Journal*. Commencing her first lactation period at the age of 1 year 357 days, Lady of Collingwood produced the fine record of 524·29 lb. butter-fat. Freshening again in thirteen months after commencing her first record, she produced in twelve months, 603·05 lb. butter-fat. Each of these productions constitutes a record performance for its class. Seeing they were so satisfac-



LADY OF COLLINGWOOD.

tory, and that the cow's development visibly improved under the testing-conditions, her owner, Mr. F. E. Hellyer, of North-east Haıbour, Dunedin, decided to test her during her third lactation period. For this third season she commenced milking in thirteen months after the date of calving for the preceding testing-period. The production for this third season evidences the fact that the cow is one able to "come again," for not only has she equalled her previous production, but she has, as a four-year-old, exceeded by no less than 133 lb. of butter-fat her fine record as a three-

year-old, being entitled to a certificate on her last season's production for 736·07 lb. fat.

Not only does this constitute a record for the four-year-old class, but it also places Lady of Collingwood's name in the list for C.O.R. Jerseys as second only to Madam Mayflower, which as a mature cow produced 763·41 lb. butter-fat. Lady of Collingwood, although having only one week's rest after producing this remarkable record, has dropped a fine heifer calf to Mr. Hellyer's imported bull Albration's Fox, and is in such good condition and producing so satisfactorily that Mr. Hellyer contemplates continuing her for her fourth consecutive year on test.

These consecutive performances indicate that Lady of Collingwood was not only possessed of outstanding capabilities as a producer of milk and butter-fat, but that she was also the possessor of a constitution which has been more than equal to the strain this work has put upon her. Her work is also ample evidence that she has been in the hands of an owner who possesses the skill and capacity required to enable even a good cow to put up this performance, which, so far as New Zealand figures stand, is unparalleled.

SUMMER PASTURES.

In the warmer parts of Hawke's Bay, Poverty Bay, &c., where dry seasons are by no means uncommon, the writer has frequently urged the importance of forming on the sheep and cattle runs a few paddocks of suitable country into summer pastures as a stand-by against drought. The pastures on many of these runs are almost annually receiving considerable injury by having the hearts of the grasses eaten out of them during a prolonged period in which they are making no growth to protect themselves from hard treatment by hungry stock. By removing stock to these summer paddocks the other pastures would be conserved, and in this way not only would the lives of many valuable grasses in the latter be preserved, but the spelled pastures would readily be able to make full use of any light showers which fell. Thus the farmer would be able to start the autumn with a fair amount of grass, instead of having winter upon him before the pastures had recovered themselves. One of the most valuable grasses for summer pastures on land suited to it is undoubtedly *Paspalum dilatatum*, which will provide feed when the bulk of the other grasses are making no growth. Owing, however, to its very strong growth, it is inadvisable to establish paspalum on good arable land which may be required for tillage.—*G. de S. Baylis, Fields Instructor, North Island.*

LIME AND MAGNESIA IN NEW ZEALAND SOILS.

B. C. ASTON, F.I.C., Chemist to the Department.

IN the December issue of the *Journal* was given some account of the controversy (which is by no means ended) as to whether it had been proved that lime and magnesia should exist in a definite ratio in soils in order to secure the best results. To the present notes are appended the results of the analysis of all soils which have been anlaysed for lime and magnesia in the Department's laboratory. Such a record will be valuable not only as a statement of the ratio in which the lime exists to the magnesia, but as a record of the small amount of lime that is present in New Zealand soils.

Hall, in his book on "The Soil," states, "What proportion of carbonate of lime is required for fertility and health is difficult to say. Probably an inferior limit of one-half of 1 per cent. of carbonate of lime (= 0·28 per cent. quicklime or calcic oxide) is the lowest that is safe." But a large number of New Zealand soils analysed, as will be seen by the tables, are near or fall short of this amount,* even assuming that the lime is all present as carbonate, which is not necessarily so in the cases under notice, where in the analysis the lime is extracted by means of strong hydrochloric acid.

The use of a weak solution of citric acid (1 per cent.) in water was first used by Bernard Dyer in an attempt to estimate in soils the amount of mineral plant-food which was probably available. Now, weak acids extract from some soils lime and magnesia in a different ratio to that extracted by strong acids—that is to say (taking the example I gave in my 1908 report), a soil which showed with strong hydrochloric acid 1 part of lime to 1·7 parts of magnesia, showed with 5 per cent. hydrochloric acid only 1 part of lime to 0·43 part of magnesia; and this statement holds good with other weak acids, such as citric and carbonic acids, and even with water.

When we come, however, to soils which are known to be sterile owing to the excess of magnesia, when the magnesia is present in quantities ten times as great as the lime, both weak and strong

* It must be noted that the figures in the tables are quoted in terms of calcium oxide (quicklime).

solvents indicate that the magnesia is in excess. An interesting point concerning the Dun Mountain soils is that the soil which will grow forest, although showing a greater amount of magnesia than lime by the hydrochloric-acid method, shows a greater amount of lime than magnesia by the 1-per-cent. citric-acid method of extraction; whereas the soil which will only grow scrub shows more magnesia than lime by both methods, as, similarly, does the soil which will not grow anything. It may be ultimately found, therefore, that the 1-per-cent. citric-acid method of Bernard Dyer may prove a means of diagnosing an injurious excess of magnesia in soils.

PERCENTAGES OF LIME AND MAGNESIA IN NEW ZEALAND SOILS.

(The figures are the percentages calculated on the sample dried at 100° Centigrade.)

Laboratory No.	Locality.	Description.	Hydrochloric-acid Extract.		Citric-acid (1 per Cent.) Extract.	
			Lime (CaO).	Magnesia (MgO).	Lime (CaO).	Magnesia (MgO).
			Per Cent.	Per Cent.	Per Cent.	Per Cent.
H/1091	Motueka Valley, Nelson	..	1·08	10·8	..	..
J/704	Wangapeka, Nelson	Fine sandy loam	0·30	0·51	0·106	0·027
705	" "	"	0·28	0·62	0·056	0·020
707	" "	"	0·20	0·48	0·068	0·027
709	" "	"	0·12	0·60	0·058	0·024
711	" "	"	0·26	0·33	0·059	0·018
713	" "	"	0·15	0·25	0·052	0·024
714	" "	"	0·24	0·45	0·054	0·018
K/576	Kohatu, Nelson	Fine sandy soil	2·00	10·95	0·10	0·24
8	Three-channel Flat, Nelson	Fine sandy clay	0·12	0·16	..	..
9	Collingwood Plains, Nelson	Loam	0·05	0·03	..	..
35	Hastings, Hawke's Bay	Fine sandy loam	0·40	0·30	..	..
41	Turakina, Wanganui	"	0·24	0·26	..	..
43	Marton, Manawatu	"	0·26	0·19	..	..
52	Sandon, Manawatu	"	0·21	0·22	..	..
57	Greatford, Manawatu	"	0·21	0·22	..	..
126	Pakihi soil, Westland	"	0·01	0·06	..	..
128	" "	"	0·01	0·05	..	..
133	" "	"	0·01	0·02	..	..
294	Rangiriri, Waikato	Clay soil	0·16	0·24	..	..
634	Bainham, Nelson	Clay loam	0·25	0·45	..	..
701	Appleby, Nelson	"	1·40	2·40	..	..
846	Norsewood, Hawke's Bay	Fine sand	0·30	0·30	..	..
871	Puramahoi, Nelson	"	0·08	0·56	0·025	0·013
875	Eketahuna, Wairarapa	Fine sandy loam	0·34	0·40	..	..
929	Lower Hutt, Wellington	Fine sandy clay	0·28	0·32	..	..
935	Eketahuna, Wairarapa	"	0·45	0·52	..	..
937	" "	"	0·40	0·32	..	..
1149	Waimangaroa, Westland	Clay soil	0·30	0·34	..	..
1151	" "	Humus soil	0·36	0·28	..	..
1153	" "	Medium sand	0·58	0·32	..	..
1158	Feilding, Manawatu	Fine sandy loam	0·48	0·40	..	..
1160	" "	"	0·56	0·22	..	..
1161	" "	"	0·41	0·20	..	..
1244	Woodend, Canterbury	Sandy clay	0·50	0·76	..	..
1245	St. Andrew's, Canterbury	Fine sandy loam	0·85	0·32	..	..
1354	Waerenga, Waikato	Fine sandy clay	0·32	0·40	..	..
1355	" "	"	0·28	0·26	..	..
1356	Palmerston, Otago	Fine sandy loam	0·40	0·34	..	..
1357	Oamaru, Otago	"	0·90	2·40	..	..
1359	Timaru, Canterbury	"	0·80	0·72	..	..
1385	St. Andrew's, Canterbury	"	0·55	0·20	..	..
1444	Makara, Wellington	Coarse sand	0·76	0·32	..	..
1445	" "	"	0·52	0·32	..	..
1512	Ohaeawai, Bay of Islands	Fine sandy loam	0·08	0·04	..	..

Laboratory No.	Locality.	Description.	Hydrochloric-acid Extract.		Citric-acid (1 per Cent.) Extract.	
			Lime (CaO).	Magnesia (MgO).	Lime (CaO).	Magnesia (MgO).
			Per Cent.	Per Cent.	Per Cent.	Per Cent.
K/1513	Ohaeawai, Bay of Islands ..	Fine sandy loam ..	0·15	0·12	..	..
1514	Whangaroa, Bay of Islands ..	" ..	0·40	0·60	..	..
1699	Herbert, Otago	" ..	0·50	0·32	..	..
2490	Rimutakas, Wellington ..	" ..	0·24	0·20	..	..
2232	Moumahaki, Wanganui ..	" ..	0·43	0·24	..	..
2234	" " ..	" ..	0·41	0·26	..	..
2236	" " ..	" ..	0·41	0·30	..	..
2238	" " ..	" ..	0·48	0·24	..	..
2240	" " ..	" ..	0·36	0·34	..	..
2242	" " ..	" ..	0·53	0·42	..	..
2244	" " ..	" ..	0·42	0·38	..	..
2248	" " ..	" ..	}			
2250	" " ..	" ..	0·56	0·44	..	..
2252	" " ..	" ..	}			
2254	" " ..	" ..	}			
2547	Rawene, Hokianga	" ..	0·18	0·17	..	..
2708	Dunedin	Loam	0·40	0·19	..	..
2709	"	Fine sandy loam ..	0·38	0·33	..	..
2742	Eltham, Taranaki	Sand	0·74	0·38	..	..
2915	Marton, Manawatu	Fine sandy loam ..	0·32	0·26	..	..
2994	Makino, Wairarapa	" ..	0·38	0·22	..	..
3025	Ohau Bay, Wellington ..	..	0·48	0·62	..	..
3026	" (subsoil of K/3025)	..	0·46	0·54	..	..
3027	"	..	0·52	0·18	..	..
3028	" (subsoil of K/3027)	..	0·42	0·22	..	..
3029	"	..	0·42	0·08	..	..
3030	" (subsoil of K/3029)	..	0·30	0·10	..	..
3031	"	..	0·44	0·18	..	..
3032	" (subsoil of K/3031)	..	0·34	0·14	..	..
3035	Carnarvon, Manawatu ..	Fine sandy loam ..	0·34	0·40	..	..
3036	Feilding, Manawatu ..	Sand	0·56	0·30	..	..
3037	" " ..	"	0·56	0·30	..	..
L/ 50	Dunedin	..	0·34	0·40	..	..
51	"	..	0·32	0·26	..	..
55	Leeston, Canterbury ..	Fine sandy loam ..	0·34	0·52	..	..
62	Halcombe, Manawatu ..	" ..	0·34	0·22	..	..
72	Rongomai, Wairarapa ..	" ..	0·417	0·39	..	..
77	Picton, Marlborough ..	" ..	0·72	0·90	..	..
78	" " ..	Loam	0·54	0·72	..	..
79	Clevedon, Auckland ..	Humus soil	0·28	0·24	..	..
216	Wellington	"	0·18	0·30	..	..
224	Greymouth	Clay loam	0·16	0·27	..	..
225	"	"	0·20	0·32	..	..
226	Braeburn, Nelson	Loam	0·40	0·54	..	..
227	Lower Moutere, Nelson ..	Fine sandy loam ..	0·16	0·22	..	..
228	Braeburn, Nelson	Fine sand	0·26	0·16	..	..
229	Lower Moutere, Nelson ..	Fine sandy loam ..	0·28	0·45	..	..
248	Humphrey's, Hokitika ..	Fine sand	0·52	0·32	..	..
249	Ngaruawahia, Waikato ..	Fine sandy soil	0·14	0·33	..	..
258	Marton, Manawatu ..	Sandy loam	0·41	0·95	..	..
267	Whakaronga, Manawatu ..	Fine sandy loam ..	0·34	0·21	..	..
274	Ruakura, South Auckland ..	..	0·28	0·20	..	..
275	" " ..	..	0·22	0·21	..	..
276	" " ..	..	0·26	0·25	..	..
277	" " ..	..	0·16	0·15	..	..
278	" " ..	..	0·20	0·18	..	..
280	Dannevirke, Hawke's Bay ..	Sandy clay ..	0·28	0·17	..	..
281	" " ..	Fine sandy loam ..	0·30	0·35	..	..
282	Wallingford, Hawke's Bay ..	Sandy clay	0·32	0·36	..	..
284	New Plymouth	Sandy loam	0·35	0·32	..	..
285	Ngaruawahia, Waikato ..	Fine sandy loam ..	0·42	0·37	..	..
287	Opotiki, Bay of Plenty ..	" ..	0·62	0·48	..	..
294	Earnscleugh, Central Otago ..	Fine sandy clay	0·30	0·52	..	..
295	" " ..	Fine sandy loam ..	0·35	0·38	..	..
425	Papatahi	Clay loam	0·42	0·18	..	..
472	Papatawa, Hawke's Bay ..	Fine sandy clay	0·60	0·16	..	..
473	Waitara, Taranaki	Fine sandy loam ..	0·37	0·35	..	..
496	Turakina, Wanganui ..	Sandy clay	0·42	0·29	..	..
500	Christchurch	"	1·46	0·60	..	..
520	Rotorua	Coarse sand	0·11	0·0	..	..
521	"	"	0·20	0·3	..	..
522	"	"	0·34	0·35	..	..
534	Sanson, Manawatu	Sandy clay	0·41	0·3	..	..
543	Apiti, Manawatu	Fine sandy loam ..	0·66	0·3	..	..

Laboratory No.	Locality.	Description.	Hydrochloric-acid Extract.		Citric-acid (1 per Cent.) Extract.	
			Lime (CaO).	Magnesia (MgO).	Lime (CaO).	Magnesia (MgO).
			Per Cent.	Per Cent.	Per Cent.	Per Cent.
L/546	Outram, Otago	Sandy clay	0·31	0·70	..	..
547	Oroua, Manawatu	Coarse sand	0·76	0·37	..	..
548	Bull's, Manawatu	Sandy clay	0·46	0·34	..	..
555	Bonny Glen, Manawatu	,,	0·24	0·16	..	..
556	Marton, Manawatu	Fine sandy loam	0·27	0·20	..	..
573	Levin, Manawatu	Clay loam	0·29	0·38	..	..
578	Blenheim, Marlborough	Sandy clay	0·12	0·23	..	..
580	Palmerston North	Fine sandy loam	0·41	0·49	..	..
624	Te Mata, Hawke's Bay	Coarse sand	0·24	0·11	..	..
625	Te Mata, Hawke's Bay (subsoil of L/624)	,, (subsoil of L/624)	0·24	0·15	..	..
627	Mackenzie country, Canterbury	,,	0·60	0·75	..	..
628	,, ,,	,,	0·53	0·67	..	..
629	,, ,,	Fine sandy loam	0·60	0·65	..	..
630	,, ,,	Fine sand	0·56	0·56	..	..
631	,, ,,	Coarse sand	0·73	0·76	..	..
638	Hororata, South Canterbury	Fine sandy loam	0·30	0·51	..	..
640	,, ,,	,,	0·31	0·50	..	..
642	,, ,,	,,	0·34	0·37	..	..
644	Kakapuaka, Auckland	Clay loam	0·24	0·30	..	..
646	Invertill	Sandy clay	0·29	0·35	..	..
685	Alton, South Taranaki	Coarse sand	0·66	0·18	..	..
694	Waimate, Canterbury	Fine sandy clay	0·46	0·38	..	..
695	,, ,,	Coarse sand	0·56	0·23	..	..
704	Bay of Plenty	,,	0·53	0·32	..	..
705	Rakamoana	,,	0·21	0·16	..	..
706	Kaikoura, Marlborough	Fine sandy loam	0·86	0·38	..	..
707	,, ,,	Clay loam	0·83	0·59	..	..
708	,, ,,	,,	1·40	0·67	..	..
709	Tikokino, Hawke's Bay	Fine sandy loam	0·32	0·16	..	..
841	Pongaroa, Wairarapa	Fine sandy clay	0·30	0·38	..	..
842	,, ,,	,,	0·35	0·42	..	..
843	,, ,,	,,	0·16	0·47	..	..
844	,, ,,	,,	0·41	0·24	..	..
845	,, ,,	,,	0·12	0·20	..	..
846	,, ,,	,,	0·12	0·20	..	..
847	,, ,,	..	0·25	0·31	..	..
848	,, ,,	..	0·15	0·25	..	..
849	Makuri, Wairarapa	Fine sandy loam	0·30	0·46	..	..
857	Waharoa, South Auckland	Fine sand	0·22	0·17	..	..
858	Te Puke, South Auckland	Peaty soil	0·25	0·10	..	..
859	,, ,,	Fine sandy soil	0·40	0·20	..	..
860	,, ,,	Coarse sand	0·56	0·26	..	..
861	,, ,,	,,	0·62	0·22	..	..
862	Ashhurst, Manawatu	Sandy clay	0·35	0·26	..	..
863	Wyndham, Otago	Fine sandy soil	0·32	0·46	..	..
864	Bonny Glen, Wanganui	Sandy clay	0·32	0·13	..	..
865	Arapohue, Auckland	Clay	0·22	0·19	..	..
895	Lower Hutt, Wellington	Sandy soil	0·07	0·06	..	..
896	,, ,,	Sandy clay	0·14	0·14	..	..
897	Longbush, Invercargill	,,	0·41	0·48	..	..
898	Palmerston North	,,	0·14	0·10	..	..
899	Auckland	Stiff clay	0·28	0·13	..	..
900	,,	Fine sandy clay	0·22	0·10	..	..
901	,,	Sandy clay	0·16	0·08	..	..
905	Woodville, Hawke's Bay	Fine sand	0·23	0·17	..	..
906	Carterton, Wairarapa	Sandy clay	0·39	0·59	..	..
A/19	Te Wharau, Wairarapa	,,	0·17	0·36	..	..
52	Levin, Wellington	,,	0·33	0·46	..	..
70	Rawene, Auckland	Clay loam	0·08	0·08	..	..
95	Pahiatua, Wairarapa	Sandy clay	0·19	0·53	..	..
112	Waipiro Bay, East Coast	Coarse sandy pumiceous soil	0·14	0·08	..	..
113	Orari, Canterbury	Medium sand	0·88	0·74	..	..
114	Geraldine, Canterbury	Sandy clay	0·62	0·51	..	..
127	Buckland, Auckland	Clay soil	0·23	0·18	..	..
161	Bull's, Wellington	Fine sandy loam	0·27	0·41	..	..
183	Wekaweka, Auckland	Sandy clay	0·11	0·09	..	..
204	Taupo	Coarse sand	1·01	0·23	..	..
266	Waitaria Bay, Pelorus Sound	Loam	0·21	0·15	..	..
267	Ruahine, Wellington	Fine sandy loam	0·22	0·11	..	..
289	Wellington City	Coarse sandy soil	0·51	0·48	..	..
290	Wadestown, Wellington	Sandy clay	0·37	0·32	..	..
312	Maungakarimu, Auckland	Very fine sandy clay	0·05	0·03	..	..
313 (1)	Mungapa, Auckland	,,	0·05	0·03	..	..

Laboratory No.	Locality.	Description.	Hydrochloric-acid Extract.		Citric-acid (1 per Cent.) Extract.	
			Lime (CaO).	Magnesia (MgO).	Lime (CaO).	Magnesia (MgO).
			Per Cent.	Per Cent.	Per Cent.	Per Cent.
A/313 (2)	Mungapa, Auckland	White clay	0·05	0·05	..	..
314 (1)	Hukerenui, Auckland	Very fine sandy clay	0·05	0·06	..	
(2)	,, ,,	Stiff white clay	0·06	0·05	..	..
315 (1)	Whangarei, Auckland	Fine sandy loam	0·05	0·03	..	..
(2)	,, ,,	Very fine sandy clay	0·06	0·03	..	..
327	Rehia, Northern Wairoa	Clay loam	0·29	0·14	..	..
328	Pongaroa, Wairarapa	Sandy clay	0·16	0·24	..	..
343	Clydevale, Otago	Fine sandy clay	0·26	0·20	..	..
354	Nelson	Clay loam	0·37	0·46		..
359	Ashburton	Fine sandy clay	0·59	0·41	..	..
360	Elgin, Ashburton	Fine sandy loam	0·39	0·66	..	..
361	Clareville, Wairarapa	Medium sandy loam	0·17	0·38	..	..
370	Crail Bay, Pelorus Sound	Clay soil	1·02	0·65	..	..
383 (1)	Waimate, South Canterbury	Fine sandy loam	0·42	0·31	..	..
(2)	,, ,,	,,	0·52	0·31	..	..
387	Clydevale, Otago	,,	0·21	0·21	..	..
403 (1)	Tai Tapu, Canterbury	,,	0·34	0·32	..	..
(2)	,, ,,	,,	0·26	0·24	..	..
404 (1)	Kawhia, West Coast	Medium sandy soil	0·15	0·20	..	..
(2)	,, ,,	Fine sandy soil	0·29	0·23	..	..
(3)	,, ,,	,,	0·23	0·26	..	..
(4)	,, ,,	Fine sandy loam	0·23	0·40	..	..
460	Clydevale, Otago	,,	0·20	0·26	..	..
463	Waipatiki, Hawke's Bay	Fine sandy clay	0·21	0·29	..	..
464	Rissington, Hawke's Bay	Coarse sandy soil	0·41	0·15	..	..
544	Onetea, Northern Wairoa	Medium sandy clay	0·17	0·29	..	..
575 (1)	Pahiatua, Wairarapa	Fine sandy clay	0·16	0·42	..	..
(2)	,, ,,	,,	0·13	0·33	..	..
735 (1)	Waikanae, Wellington	Fine sandy loam	0·23	0·27	..	..
(3)	,, ,,	Fine sandy clay	0·33	0·06	..	..
(4)	,, ,,	Sand	0·39	0·43	..	..
741	Okaihau, Bay of Islands	Fine sandy clay	0·12	0·08	..	..
869 (1)	Te Puriri, Auckland	Sandy clay	0·12	0·14	..	..
(2)	,, ,,	Clay soil	0·11	0·13	..	..
(3)	,, ,,	Clay loam	0·09	0·08	..	..
(4)	,, ,,	Clay soil	0·06	0·10	..	..
(5)	,, ,,	Fine sandy clay	0·13	0·15	..	..
(6)	,, ,,	Clay soil	0·10	0·18	..	..
913 (1)	Kumeu, Auckland	Fine sandy clay	0·09	0·03	..	..
(2)	,, ,,	..	0·09	0·05	..	..
(5)	,, ,,	White sandy clay	0·09	0·05	..	..
(6)	,, ,,	..	0·11	0·06	..	..
(9)	,, ,,	Grey sandy clay	0·12	0·04	..	..
(11)	,, ,,	Fine sandy loam	0·13	0·05	..	..
1069	Waitomo Caves, Auckland	Fine sandy soil	0·15	0·13	..	..
1071	Ashburton	Fine sandy clay	0·33	0·54	..	..
1072	Kelso, Otago	,,	0·43	0·29	..	..
B/43	Gordonton, Waikato	Black clay soil	0·20	0·07	..	..
284	Waiharakeke, Waikato	Light-brown fine sandy soil	0·37	0·23	..	..
345 (2)	Cambridge, Waikato	Stiff light-brown sandy clay	0·21	0·30	..	..
(3)	,, ,,	Rather stiff light-grey sandy clay	0·21	0·20	..	..
405	Te Moana, Canterbury	Fine sandy loam	0·48	0·28	..	..
409	Westport	Greyish-brown clay loam	0·07	0·09	..	..
410	Uritane, Waimate	Light-brown fine sandy loam	0·64	0·42	..	..
512	South Norsewood, Hawke's Bay	Dark-brown sandy loam	0·32	0·11	..	..
519 (1)	Cowes, Auckland	Rather stiff light-brown sandy clay	0·53	0·12	..	..
(2)	,, ,,	Brown, coarse sandy clay	0·30	0·33	..	..
(3)	Cowes, Auckland (composite of 3 samples)	Stiff greyish-brown coarse sandy clay	0·20	0·10	..	..
521 (1)	Mackenzie country, Canterbury	Loose light-grey fine sandy loam	0·70	0·60	..	..
(2)	,, ,,	Loose light-brown fine sandy loam	0·54	0·73	..	..
(3)	,, ,,	Loose light-grey sandy soil	0·65	0·60	..	..
522	Herbert, Otago	*Rather stiff light-brown* sandy clay	..	..	..	..
531	Hastings, Hawke's Bay	Dark greyish-brown sandy loam	0·68	0·18	..	..
566	Makuri, North Wairarapa	Rather stiff brown fine sandy clay	0·30	0·46	..	..
591	Oroua Downs, Manawatu	Dark coarse sand	0·60	0·28	..	..
592	Hunterville, Manawatu	Light-brown fine sandy loam	0·38	0·30	..	..

Laboratory No.	Locality.	Description.	Hydrochloric-acid Extract.		Citric-acid (1 per Cent.) Extract.	
			Lime (CaO).	Magnesia (MgO).	Lime (CaO).	Magnesia (MgO).
			Per Cent.	Per Cent.	Per Cent.	Per Cent.
B/614	Aongatete, Bay of Plenty ..	Loose grey coarse sandy soil	0·22	0·13	..	..
629 (1)	Waihi, Auckland	Friable greyish-brown coarse sandy loam	0·16	0·14	..	..
(2)	,, ,, ...	Loose greyish-brown coarse sandy loam	0·39	0·20	..	..
634	Ryde, Auckland	Stiff greyish-brown fine sandy clay	0·16	0·12	..	..
646 (1)	Hukerenui, North Auckland ..	Rather stiff fine sandy clay	0·10	0·15	..	..
(2)	,, ,, ..	,,	0·15	0·11	..	..
(3)	,, ,, ..	Light-brown fine sandy loam	0·23	0·29	..	..
663	Balclutha, Otago	Grey fine sandy clay soil ..	0·23	0·19	..	..
676 (1)	Pounawea, Otago	Grey coarse sand ..	0·42	0·21	..	..
676 (2)	,, ,, ...	Light-yellow fine sandy clay	0·35	0·44	..	..
678	Mana Island, Wellington ..	Dark-brown fine sandy loam	0·33	0·23	..	..
684	Fitzherbert Hills, Palmerston North	Light-brown fine sandy loam	0·25	0·25	..	..
712	Tapanui, Otago	Fairly friable grey fine sandy clay	0·13	0·30	..	..
713	,, ,, ...	Fairly friable grey fine sandy loam	0·17	0·26	..	..
714	*Kelso, Otago*	*Grey fine sandy loam* ..	*0·27*	*0·34*	..	..
715	,, ,, ...	,, ..	0·24	0·23	..	..
719	Pomahaka, Otago	Grey fine sandy clay ..	0·16	0·29	..	..
720	,, ,, ...	,, ..	0·35	0·51	..	..
733	Tapanui, Otago	Friable grey fine sandy loam	0·50	0·66	..	..
734	Heriot, Otago	Grey fine sandy loam ..	0·30	0·47	..	..
755	Roxburgh, Otago	Greyish-brown fine sandy loam	0·32	0·53	..	..
787	Popauma, Waimarino ..	Dark-brown fine sandy loam	0·44	0·18	..	..
792 (1)	*Otapiri Gorge, Southland* ..	*Light-brown fine sandy clay soil*	*0·32*	*0·48*	..	..
(2)	,, ,, ..	Ditto	0·21	0·58	..	..
803 (1)	Otaio, Canterbury	Grey fine sandy loam ..	0·57	0·37	..	..
(2)	,, ,, ...	,, ..	0·53	·45	..	..
804	Studholme, Canterbury ..	,, ..	0·50	0·48	..	..
805 (1)	Waimate, Canterbury ..	,, ..	0·45	0·30	..	..
(2)	,, ,, ..	Grey fine sandy clay ..	0·54	0·39	..	..
826	Waitaki, Canterbury ..	Fine sandy loam ..	0·33	0·24	..	..
827	,, ,, ..	,, ..	0·88	0·62	..	..
828	,, ,, ..	,, ..	0·45	0·32	..	..
829	,, ,, ..	,, ..	0·35	0·41	..	..
834	Manutahi, Wellington ..	Loose coarse sandy soil ..	0·22	0·13	..	..
849 (1)	Lawrence, Southland ..	Coarse sandy loam ..	0·50	0·28	..	..
(2)	,, ,, ..	,, ..	0·43	0·24	..	..
914	Kohatu, Nelson	Coarse sandy clay ..	0·34	0·24	..	..
917	Taumarunui, Wanganui River	Light-brown fine sandy loam	0·24	0·26	..	..
939 (1)	Otaraia, Southland	Brown coarse sandy loam	0·36	0·85	..	..
(2)	,, ,, ...	Brown fine sandy clay ..	0·20	0·58	..	..
941	Kopua, Hawke's Bay ..	Loose coarse sandy loam ..	0·33	0·37	..	..
943	Waipu, North Auckland ..	Very dark coarse sandy clay soil	0·15	0·18	..	..
1072	Hamilton Waikato	Coarse sandy loam ..	0·90	0·08	..	..
745	Gore, Southland	Stiff fine sandy clay ..	0·27	0·63	..	..
845	Geraldine, Canterbury ..	Clay loam	0·61	0·76	..	..
846	Pleasant Point, Canterbury ..	Fine sandy clay soil ..	0·60	0·21	..	..
847	Lovell's Flat, Otago ..	Rather stiff grey clay loam	0·45	0·33	..	..
848	*Stirling, Otago*	*Friable light-grey fine sandy loam*	0·74	0·80	..	..
915	Hampden, Otago	Fine sandy loam ..	0·36	0·32	..	..
916	Waitaki, Otago	,, ..	0·48	0·34	..	..
944	Cromwell, Otago	,, (mica silt)	0·41	1·01	..	..
945 (1)	Coal Creek, Otago	,, ..	0·12	0·47	..	..
(2)	,, ,, ...	Clay loam	0·29	0·88	..	..
1033	Te Moana, Canterbury ..	Sandy loam	0·36	0·57	..	..
1034	*Timaru, Canterbury* ..	*Clay loam*	*0·39*	*0·29*	..	..
1035	Otekaike, Otago	Light-greyish-brown clay loam	0·59	0·92	..	..
1036	,, ,, ...	Brown fine sandy loam ..	0·94	0·86	..	..
1037	Kurow, Otago	Brown sandy loam ..	0·90	0·85	..	..
1038	Hakataramea, Otago ..	Light-brown friable sandy loam	0·48	0·42	..	..
C/61	Ohakune, Wellington ..	Friable brown coarse sandy loam	0·53	0·10	..	..

Laboratory No.	Locality.	Description.	Hydrochloric-acid Extract.		Citric-acid (1 per Cent.) Extract.	
			Lime (CaO).	Magnesia (MgO).	Lime (CaO).	Magnesia (MgO).
			Per Cent.	Per Cent.	Per Cent.	Per Cent.
C/77	Rarotonga, Cook Islands ..	Stiff dark-brown fine sandy clay	0·78	0·28	..	..
135	Pleasant Point, Canterbury ..	Sandy clay	0·61	0·62	..	..
146	Upper Mangorei, New Plymouth	Light-brown friable coarse sandy loam	0·27	0·14	..	..
201	Inaha, Hawera	Very dark fine sandy loam	0·42	0·21	..	..
299 (1)	Hokitika (pakihi soils) ..	Light-brown silt ..	0·08	0·04	..	..
(2)	" " ..	Grey silt	0·08	0·05	..	..
(3)	" " ..	Dark-brown fine sandy loam	0·07	0·06	..	..
300	" " ..	Light-brown fine sandy loam	0·07	0·06	..	..
301 (1)	" " ..	Grey coarse sandy loam ..	0·05	0·08	..	..
(2)	" " ..	Greyish-brown coarse sandy loam	0·05	0·05	..	..
(3)	" " ..	Grey coarse sandy loam ..	0·02	0·05	..	..
(4)	" " ..	*Brown coarse sandy loam*	0·04	0·05	..	..
366	Kaipara, North Auckland ..	Brown fine sandy loam ..	0·13	0·11	..	..
875	West Eyreton, Christchurch ..	Brown fairly friable coarse sandy loam	0·28	0·49	..	..
898	Waihao Forks, Canterbury ..	Light-brown fairly friable fine sandy loam	0·39	0·37	..	..
	Catlin's River District of Otago.					
	Section 6, Block III, Tautuku—					
B/1042–1	Tahakopa foothills ..	Brown fine sandy clay ..	0·20	0·42	0·041	0·027
Subsoil	Subsoil of above	Brownish-yellow fine sandy clay	0·19	0·52	0·026	0·017
	Section 1, Block III, Tautuku—					
2	*River-flat*	*Brown friable fine sandy loam*	*0·32*	*0·68*	*0·180*	0·037
Subsoil	Subsoil of above	Coarse sandy clay ..	0·20	0·63	0·120	0·023
3	River-flat	Brown fine sandy clay ..	0·27	0·56	0·190	0·034
4	"	Dark-brown fine sandy loam	0·24	0·52	0·120	0·030
	Section 19, Block XIII, Rimu—					
5	River-flat, Tahakopa ..	Plant-remains	0·14	0·19	0·058	0·017
	Section 20, Block XIII, Rimu—					
6	River-flat	Brown friable fine sandy loam	0·38	0·78	0·163	0·040
	Section 30, Block X, Woodlands—					
7	Pillans Head, littoral hillside	Dark-brown fine sandy loam	0·49	1·00	0·224	0·200
	Section 1, Block IX, Woodlands—					
8	Tahakopa Bay	Blown sand; reddish-brown humus	0·82	0·20	..	..
9	"	Blown sand; loose greyish coarse sand	0·37	0·32	0·260	0·130
	Section 16, Block IV, Tautuku—					
10	Papatowai foothills ..	Light-brown fine sand ..	0·37	0·70	0·130	0·050
	Section 4, Block XIII, Rimu—					
11	Tahakopa foothills ..	Brown fine sandy clay ..	0·25	0·77	0·080	0·029
	Section 9, Block XIV, Rimu—					
12	Caberfeidh Mountain, 1,143 ft.	Dark-brown fine sandy clay	0·18	0·23	0·070	0·015
13	" 500 ft.	Brown fine sandy loam ..	0·33	0·41	0·100	0·036
	Section 10, Block III, Tautuku—					
14	Tahakopa foothills ..	Brown fine sandy clay ..	0·26	0·59	0·030	0·014
	Section 1, Block XV, Rimu—					
15	Kahuika foothills ..	Light-brown friable fine sandy clay	0·39	1·03	0·130	0·090
16	Kahuika river-flat	Light-brown fine sandy clay	0·55	0·95	0·230	0·061
	Section 4, Block VI, Woodlands—					
17	Kahuika foothills ..	Light-brown fine sandy clay	0·57	0·35	0·100	0·046
	Section 4, Block III, Woodlands—					
18	Hine Hill, Ratanui, up to 1,000 ft.	Light-brown fine sandy loam	0·78	1·03	0·300	0·130
	Section 14, Block I, Woodlands—					
19	Catlin's Head, coastal hills	Light-brown fine sandy clay	0·40	0·47	0·220	0·090
	Section 5, Block I, Woodlands—					
20	Catlin's Head, coastal hills ..	Dark reddish-brown organic	0·43	0·40	0·130	0·090
	Section 14, Block I, Woodlands—					
21	Catlin's Head, littoral hillside	Light greyish-brown fine sandy loam	0·34	0·24	0·160	0·160

Laboratory No.	Locality.	Description.	Hydrochloric-acid Extract.		Citric-acid (1 per Cent.) Extract.	
			Lime (CaO).	Magnesia (MgO).	Lime (CaO).	Magnesia (MgO).
			Per Cent.	Per Cent.	Per Cent.	Per Cent.
B/22	Section 4, Block I, Woodlands—River estuarial flat ..	Brown coarse sand ..	0·59	0·25	0·440	0·049
23	Section 4, Block V, South Molyneux—Romohapa hillside ..	Light-brown fine sandy clay	0·21	0·31	0·060	0·038
24	Section 10, Block V, Clutha—Molyneux alluvial flat ..	Friable dark-brown fine sandy clay	0·33	0·30	0·190	0·098
E/207–1	Sherry River, Nelson ..	..	0·14	0·12	..	..
2	" " ..	..	0·16	0·09	..	..
3	" " ..	..	0·11	0·05	..	..
4	" " ..	..	0·15	0·11	..	..
5	" " ..	..	0·29	0·22	..	..
D/1024	Dun Mountain, Nelson ..	..	4·70	15·33	0·083	0·303
E/207–7	" " ..	..	2·91	13·86	0·10	0·25
8	" " ..	..	3·68	2·14	0·11	0·05

FORTHCOMING AGRICULTURAL SHOWS.

Woodville A. and P. Association: Annual Show at Woodville, 26th January.

Broadwood A. and P. Association: Show at Broadwood, 27th January.

Helensville A. and P. Association: Annual Show at Helensville, 29th January.

Feilding Industrial A. and P. Association: Annual Show at Feilding, 1st and 2nd February.

Golden Bay A. and P. Association: Annual Show at Takaka, 1st February.

Central A. and P. Association: Annual Show at Waipukurau, 2nd February.

Tapanui Farmers' Club: Annual Show at Tapanui, 2nd February.

Ohakune A. and P. Association: Summer Show at Ohakune, 6th and 7th February.

Dannevirke District A. and P. Association: Show at Dannevirke, 9th and 10th February.

Te Puke A. and P. Association: Annual Show at Te Puke, 10th February.

Pahiatua-Akitio A. and P. Association: Annual Show at Pahiatua, 11th February.

Marton District A. and P. Association: Annual Show at Marton, 11th February.

Waimarino A. and P. Association: Show at Raetihi, 17th February.

Rangitikei A. and P. Association: Autumn Show at Taihape, 23rd February.

Franklin A. and P. Association: Annual Show at Pukekohe, 25th and 26th February.

Northern Wairoa A. and P. Association: Annual Show at Aratapu, 26th February.

Opotiki A. and P. Association: Show at Opotiki, 2nd March.

Oruru A. and H. Society: Annual Show at Oruru, 3rd March

Hawke's Bay A. and P. Society: Autumn Show at Hastings, 7th and 8th March.

Ashburton A. and P. Association: Annual Show at Ashburton, 15th and 16th March.

Kaikoura A. and P. Association: Annual Show at Kaikoura, 17th March.

Amuri A. and P. Association: Annual Show at Waiau, 21st March.

Temuka and Geraldine A. and P. Society: Show at Temuka, 30th March.

Oxford A. and P. Association: Annual Show at Oxford, 6th April.

Mackenzie County A. and P. Society: Annual Show at Fairlie, [illegible]

BOARD OF AGRICULTURE.

At a meeting of the Board of Agriculture, held at Wellington on the 9th December, 1915, Sir James Wilson, President, in the chair, a number of matters that had been referred to the Board by the Minister of Agriculture were dealt with.

Among the correspondence dealt with was a letter referring to the amendment of the Fertilizers Act in regard to the differentiation of unit values in phosphates of varying solubility. The method of valuing fertilizers was discussed with Mr. Aston, the Chemist of the Department, and the Board decided to recommend that steps be taken in the direction of amending the New Zealand law so as to bring it into line with similar Acts in other countries ; also that the question of the fineness of ground phosphate rock should be considered.

A letter was received in reference to the collection of the sheep returns. After the question had been considered it was decided not to make any further alteration in the conclusion already arrived at—viz., that the returns should be collected by the Department of Agriculture at the 30th April, as provided by the existing law, and that these figures should be checked with the shearing tallies to be taken by the Government Statistician when collecting agricultural and pastoral statistics as at the 31st January.

A letter was received from the Stratford Agricultural and Pastoral Association urging the necessity for the establishment of a model dairy farm in Taranaki. The matter was deferred until the next meeting to enable the Board to confer with its Taranaki member, who was absent from the meeting through illness.

Considerable time was occupied in the final discussion of the report to the Minister of Agriculture as to the best policy to be adopted in connection with the Department's experimental farms. All the members of the Board having visited the farms and presented reports in reference thereto, the final report was drafted, and will be forwarded on to the Minister in due course.

An offer to sell to the New Zealand Government the perpetual lease of a number of phosphate-bearing islands in the Pacific engaged the consideration of the Board. Careful inquiries had been made in reference to the matter, and it was finally decided, after obtaining reports from officers of the Department, that the present was not an opportune time to enter into any such negotiations, and the Board could not therefore recommend the Government to go any further in the matter.

The Board had an interview with Mr. Brodrick, the recently appointed Under-Secretary for Lands, with whom the question of forestry was discussed. The Board expressed the hope that, even under the present financial strain, there would be no curtailment of the usual tree-planting, in view of the rapid depletion of our timber-supplies.

The question of experimental farms and the education of cadets at these institutions was discussed with Mr. Pope, Secretary of Agriculture, and Mr. Brown, Director of the Fields Division, and the latter's views on the subject of rural education were also detailed to the Board.

Mr. Pope intimated to the Board that pasture top-dressing experiments had been started at the Wallaceville farm on the lines which had been suggested by the Board at an earlier meeting. Unfortunately, the members of the Board had not time on this occasion to visit the plots, but they hoped to do so later, when the experiments were in a more advanced stage.

The Board also had an interview with Mr. Collins, of the Labour Department, in reference to the subject of farm labour, particularly in view of harvesting operations. Mr. Collins read reports from officers of his Department throughout New Zealand, from which it appeared clear that the shortage of farm labour would not be so serious at at first contemplated, there being only two or three districts where a more than average crop was expected ; in other districts, owing to the weather-conditions causing the crops to be light, farmers had in many cases decided to mutually assist one another. It was therefore hoped to get over the difficulty of the shortage of labour caused through the present abnormal condition of affairs.

A number of other matters of a confidential nature were discussed by the

WORK FOR THE COMING MONTH.

NEW ZEALAND is a country of wide variation in climatic and soil conditions. In applying suggested procedure it is, therefore, necessary for the farmer to amend it to suit local weather-conditions and the requirements of his soil—information which can best be ascertained by a study of these problems on the part of the farmer himself. Nothing can take the place of local knowledge. Little advice on an agricultural subject is capable of general application in its entirety.

THE FARM.

SEED-MIXTURES FOR PASTURES.

SOME notes on the seeding of bush burns and other permanent pastures generally may prove of service to farmers who are about to secure their supplies of seeds for this purpose.

Cocksfoot and perennial rye-grass form the bulk of most grass-seed mixtures. The question with regard to cocksfoot is not as to whether it should be sown, nor how little may be sown, but how much may be included without overdoing it. Cocksfoot-seed is expensive now, but, expense notwithstanding, there will be no regrets on the part of the farmer who deals out the cocksfoot with a generous hand. There is less agreement on the subject of rye-grass. It is only on rich moist-bottom land that rye-grass is permanent, but the great wealth of succulent nutritious feed which it throws in the early stages of pasture-formation is such that few farmers can afford to dispense with it. Nor does there appear to be any valid reason why the farmer should not avail himself of the special advantages of rye-grass, even to the extent of sowing the Italian variety, which is still more rapid and vigorous if still of shorter duration, provided the permanent grasses are included in such quantity as to assure the future of the pasture after the rye-grasses have disappeared.

Other big permanent grasses which it is advisable to include, in greater or less measure according to circumstances, are meadow-foxtail for good soils which are normally well supplied with moisture; timothy for similar situations, and specially for cattle-grazing; and meadow-fescue for all but thin, dry soils. To complete the sward, crested dogstail and rough-stalked meadow-grass (*Poa trivialis*) are

valuable. Likewise smooth-stalked meadow-grass (*Poa pratensis*), despite its repute as a bad twitch, is one of the best sward grasses for land which is to remain indefinitely in grass.

Of leguminous pasture plants, the three clovers—red or cow-grass, alsike, and white—are all worthy of place. The red clover may be omitted from pasture intended only for sheep. Alsike-clover seed is almost certain to contain more or less Californian-thistle seed, and prudence may dictate leaving out this valuable clover on that account. Trefoil is a useful constituent of a sheep pasture, and *Lotus major* or *Lotus corniculatus* may be included—the former for moist and the latter for dry soils.

Farmers who have not definite experience of the subject of grass-mixtures may accept the following as good and representative mixtures for all better-class land:—

	Rich Heavy Cattle Land. lb.	Good Quality Land for Mixed Stocking. lb.
Perennial rye-grass	4	4
Italian rye-grass	4	4
Cocksfoot	6	8
Meadow-fescue	2	4
Meadow-foxtail	3	2
Timothy	2	1
Crested dogstail	1	1
Poa pratensis	..	1½
Poa trivialis	1	..
Red clover	2	..
Alsike clover	1½	1½
White clover	1½	1½
Trefoil	..	1½
Lotus major, or *Lotus corniculatus* for dry soils	..	¼
Total pounds per acre	28	29¼

The quantities given are primarily intended for bush burns; for ploughed land they may be somewhat increased proportionately.

Both mixtures will cost very nearly £1 10s. per acre. This is very high, but all grass and clover seeds are abnormally high at present. The mixtures could be cheapened, of course, by proportionately reducing quantities, but this is not desirable. Another alternative would be to cut down or omit meadow-foxtail, which is dear, and substitute cocksfoot. Meadow-foxtail is, however, such a valuable grass on land under good rainfall (40 in. upwards) that, given this condition, one should think twice before adopting that step.

While a very little Chewing's fescue might be included in the second mixture, its presence would confer a very doubtful advantage. Chewing's fescue and other small fescues, together with species of agrostis (red-top, brown-top, and fiorin) and danthonias, are adapted for ridges, spurs, and thin uplands where the better grasses do

not flourish. In such circumstances the following mixture, with modifications, is suitable for wide application:—

	lb.
Perennial rye-grass	5
Cocksfoot	8
Tall fescue	2
Chewing's fescue	2
Danthonia pilosa	2
Fiorin	1
Crested dogstail	2
Poa pratensis	1
White clover	1
Trefoil	1
Total pounds per acre	25

Here again expense may be a serious consideration. The only feasible way to cheapen the mixture is to substitute cheap tall fescue for a part of the expensive cocksfoot, assuming, of course, that there is no danger of the former eventually infecting good land. Tall fescue, which is a curse on good land, is here in its proper place. Patches of it may be seen on hill country throughout New Zealand—green and inviting amid dry surroundings, and closely grazed and relished by sheep.

FORAGE CROPS.

Good permanent pasture is the mainstay of farming in this country, but the up-to-date dairy-farmer or sheep-farmer on arable land knows that pasture alone without a proportion of supplementary forage crops cannot result in success at the present values of land in New Zealand. These crops can be readily and cheaply grown after stubble. Now is the time to get busy. Barley, oats, rye-grass, tares (alone and in combination), crimson clover, Western Wolths rye-grass and cow-grass, chou moellier, thousand-head kale, and buda kale are all available for autumn sowing. It is a good plan to seed a portion of the stubble to forage crop and the balance to grass. The area devoted to forage crops can be grassed the following autumn, thus providing an additional area of fresh young grass at that season, while the forage crop can be conveniently and advantageously fed off in conjunction with the grass sown at the same time.

LUCERNE AND PRAIRIE-GRASS.

Grass is good; grass plus annual forage crops is better. But the farmer has not reached perfection in farm-management until he has added to his resources established areas of lucerne and prairie-grass—forage and fodder crops of extraordinary merit and comparatively long duration. There can be no trouble from shortage of feed on the one hand or overabundance on the other where these

crops are made to answer for part of the fodder and forage requirements, for they can be grazed, cut and fed green, hayed or ensiled according as circumstances warrant or require.

Every farmer who is not a lucerne-grower should take counsel with himself. He should be critical of his methods; albeit a very brief review of his experience will bring home to him occasions when a small paddock of lucerne would have not only averted losses and saved him much anxiety, but would have added substantially to his income. An old Scotch farmer, speaking recently of just such an experience, remarked that it was very easy to be wise *ahin haun* (after the event)—a shrewd enough observation, but not one with which to casually dismiss such an all-important subject. We want more "go" and enterprise, and less passive resistance to desirable change, with its inevitable sequel of vain and futile regret.

Now is the farmer's opportunity to be up and doing. The potato-patch, or a few acres of stubble, clean and in good heart, will suffice for a start. Plough with a good furrow, apply a few hundredweights of lime to the surface, disk or harrow and lightly roll alternately as often as weeds show. Finally roll and broadcast 15 lb. to 18 lb. of seed per acre, or drill 10 lb. to 12 lb., using every coulter. Allow at least 2½ cwt. of manure composed of superphosphate 4 parts, blood-and-bone 1 part. Chain or brush harrow, and roll again. Rolling prior to seeding is essential, or seed will be buried too deep to germinate. Moreover, lucerne, like clovers, flourishes on a firm seed-bed. Moisture is drawn upwards, and quick germination results.

There is no real advantage in seeding in rows for purposes of intercultivation. With the best intention this process is sure to be omitted at one stage or other; the weeds get away and the lucerne is settled. On the other hand, when lucerne is only a few inches high its root has already penetrated to a considerable depth. Harrowing over the young plant with tine or spring-tooth at this stage does not injure it, while it cuts out young weeds. Once the lucerne gets away its close growth gives weeds no chance, and the maintenance of the plot thereafter is easy.

Prairie-grass may be seeded with lucerne up to about 10 lb. per acre. The combination is an ideal one. It is, however, a great advantage to have a paddock of pure prairie-grass for winter and early-spring feed. If not too severely grazed in winter, and if cut in summer just as the seed-heads emerge, prairie-grass will last several years, and when it begins to thin out will often re-seed itself successfully. The initial seeding of prairie-grass should be fairly heavy—say, 45 lb. per acre.

CULTIVATION OF ROOT CROPS.

Drilled crops of mangels and swedes have made great progress since they were hoed. We have not, however, seen the last of spurrey, fat-hen, and other weeds. With hay and grain harvest in full swing, the scufflers for the most part have been rusting at the bottom of the drills, and the weeds have been gaining. The final cultivation is too apt to be omitted, notwithstanding that it frequently means the difference between a light and a full crop. Every endeavour should be made to get through the crops once more and to hand-pull the big weeds missed close up to the plants.

STACK ENSILAGE.

Attention is directed to the possibility of converting into stack ensilage crops of maize, sorghum, and Japanese millet in excess of the needs of stock in the immediate future. The method of cutting maize and sorghum by means of a sledge fitted with a short length of scythe-blade and a guide for laying the cut stalks in swathes is well known. The site of the stack should be near the crop. Erect a framework of poles by putting uprights in the ground at every 4 ft. along the sides, and brace the whole structure together lengthwise and across with poles at about 14 ft. from the ground, but allowing for a movable brace at the end where the whip-hoist travels. Bush sledges are handier than drays for hauling the stuff to the stack. The fodder is loaded on to short lengths of rope to be used as slings in hoisting to stack. Three slingfuls give a one-horse-sledge load.

The crop should be cut when succulent—*i.e.*, grain in the milk stage. The material should be placed lengthwise on the stack. Build the ends over fully 3 ft., and bind the layers back evenly without any apparent junction at the lap. Be particular in placing the fodder along the sides. Stalks should be placed there by hand, so that equal lengths project beyond each pair of uprights. Thus the whole side is made compact, with a minimum of air-space and projecting ends. Settling takes place in the centre more than at the sides. This must be allowed for by providing a full camber as the building proceeds. Trim off the ends occasionally with a hay-knife, and spread on top of the stack. Settling is hastened by throwing wires over the stack and attaching weights to the ends. When completed, soil is hoisted to give deadweight pressure, but before doing so a considerable bulk of grass and weeds should be placed on top of the fodder, and watered down. The centre of the stack having a good camber, the soil may be placed in position at the rate of 400 lb. per square yard.

FOR DRY CONDITIONS.

Another dry year has to be added to Canterbury's record. Despite it all, real good crops of wheat here and there reveal Canterbury's extraordinary potentialities. Two things are, however, indispensable to profitable production under habitual dry conditions —viz., humus and cultivation: the former to absorb moisture, the latter to prevent its escape by surface evaporation. These two essentials are not compatible one with the other. The more thorough the cultivation, the more rapid the destruction of humus, and consequently the greater the necessity for restoring it. A really good crop of fat-hen turned under at the flowering stage would be the making of some Canterbury paddocks. Failing that, farmers would be well advised to sacrifice the second growth of rape as feed in favour of the soil on much-cropped paddocks. Recourse may also be had to a stubble-seeding of mustard, to be eventually ploughed under.

Stubble-paddocks in good heart which are to carry another cereal crop should at once be disked where practicable, otherwise skimmed, to conserve moisture and to spring weeds. Moisture evaporates rapidly from unstirred stubble-land. There will be a temptation to hold on to old lea as long as possible for the sake of the scanty feed it may supply, and on the chance of a good season next year. If, however, it is really intended to break lea for autumn wheat, it should be carried out wherever and as soon as ever skimming can be reasonably done.

LIVE-STOCK.

The dipping of the flock with a poisonous dip should now be undertaken, if not already done. Ewes and rams should be mated generally throughout the North Island during the month. A week or more beforehand the ewes may be moved on to rape or other fresh feed for a part of each day, unless already in good mating-condition. It is generally conceded that the effect of thus "flushing" or artificially stimulating ewes is to produce a greater percentage of lambs and fewer barren ewes. In most districts, however, the breeder's difficulty will be to prevent ewes from getting too fat. Either extreme should be avoided for best results. Lambs should be kept in improving condition, being gradually brought on to rape or rape and Italian, with the run of a good fresh grass-paddock or the hay-stubbles, and easy access to water. Ewe lambs to be retained as hoggets should be kept on short sweet pasture and frequently changed.

Store pigs from early litters should now be confined to fattening-pens, and their progress hastened by liberal supplies of separated

milk, or whey and pollard, seconds of wheat and barley, peas, rape, lucerne, clover, potato-chats, &c. There is nothing gained by keeping pigs too long in store condition. It has been frequently shown that the amount of food required to produce 1 lb. of increase in weight increases rapidly as pigs grow heavier. When pig-keeping is reduced to a business the aim is to keep the pigs moving forward quickly from birth to maturity without any distinct "store" stage.

Good young boars have been in demand. Pig-breeders should secure a vigorous young boar in plenty of time for mating with sows for spring litters. Length and depth, with strong bone and constitution, are the essential points of good sows. The boar, on the other hand, should be selected for those points which indicate early maturity—viz., short (but deep) in body, short-jowled, with fine bone and hair, not too strong in shoulder, and well-developed hams.

THE ORCHARD.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

SPRAYING.

THE principal orchard diseases for which spraying is necessary during February include codlin-moth, leech, powdery mildew, and woolly aphis.

Codlin-moth.—Continue to spray at intervals of not more than three weeks with arsenate of lead. The strength required is 1½ lb. to 2 lb. of paste arsenate of lead to 50 gallons of water. Powdered arsenate should be used at a little more than half the strength of the paste. In regard to spraying for codlin-moth, one of the most important matters to decide at this season of the year is when this work can be safely terminated without danger of late infection taking place. This is an important question, and can only be decided after taking into consideration the general climatic conditions of the locality together with those prevailing toward the end of the month. Generally speaking, both apples and pears are liable to moth-infection throughout the month of February, and in the warmer districts well on to the end of March. In this respect is it always well to be on the safe side, as practically every fruit-grower, both commercial and private, is aware from past experience of the disastrous effect late attacks of moth have on fruit intended for storing or shipping. But despite past experience there are still many cases in which undue risk is run, resulting in much unnecessary loss every season.

In addition to correctly deciding when to cease spraying the main crop, there is also the question of how long before picking spraying should cease in regard to summer fruits. That is a matter which at this stage is of more immediate importance. The maximum length of time that can be allowed between sprayings in the earlier part of the season cannot be safely allowed between the last spraying and the harvesting of the fruit.

A period of three weeks is the average length of time allowed between sprayings, whilst some growers are content with spraying about every four weeks. In the latter case moth-affection invariably takes place to some extent before the next lot of spray is applied, but when this is done the grub, if not too far advanced, is destroyed, resulting usually in nothing more serious than a certain percentage of "moth-stung" fruit. In either case moth-eggs are to be found on the fruit, which if not prevented would develop and grub-infection result. This latter development is exactly what takes place when the period between the last spraying and picking is too great.

No doubt many cases of fruit which have been considered quite all right by the packer have been condemned on the markets in the past owing to moth-affection becoming evident after packing. In supplying our own local markets it is necessary to guard against packing fruit affected with moth in the incipient stage referred to, but the necessity is infinitely greater in regard to fruit being packed for export.

The earlier export varieties are usually left on the trees as long as possible for the benefit of colour and maturity. Picking, packing, and shipping takes place immediately, allowing insufficient time for the presence of the grub in fruit affected in this way to become noticeable. Such fruit is sure to be in an unsatisfactory condition by the time it arrives at its destination. To guard against this danger it is not advisable to allow a period of more than ten days to a fortnight between the last spraying and picking until all danger of moth-attacks is past.

Leech.—Pip-fruits: Spray with arsenate of lead as advised for codlin-moth. Stone-fruit: Spray with arsenate of lead at half the strength recommended for pip-fruits.

Powdery Mildew.—Spray with commercial lime-sulphur at the rate of 1 to 100. Lime-sulphur can be used in conjunction with arsenate of lead.

Woolly Aphis.—Since the advent of oil sprays the orchardist can afford to look upon woolly aphis with less concern than of yore. Many useful varieties of apples which in some localities were considered practically impossible in the past owing to this pest can

now be grown with comparative immunity with the assistance of oil sprays when properly used.

Practically every orchardist in New Zealand uses emulsified oil more or less during the winter, but unfortunately there are still many who from the point of view of economy or from fear of damage to the tree use a very dilute mixture, with the result that not only woolly aphis but other soft-bodied insects are kept only moderately in check. In such cases, or where no oil has been used in the winter, woolly aphis will doubtless be found during the summer months to be doing considerable damage to the fruiting portions of the tree.

The insect thrives particularly well on the succulent soft wood to be found in the shaded centres of densely growing young trees. In such cases summer pruning can be resorted to with advantage not only for the control of woolly aphis, but also for the future benefit of the tree itself. Summer pruning is practised for purposes other than forcing the tree into an immediate state of fruit-production. For the present purpose all that is advocated is the removal of all surplus growths which tend to overcrowd and shade the permanent portions of the tree. This when done late in the season has the effect of checking the tree's growth; but probably the greatest benefit gained from a fruit-producing point of view is in providing free access of air and light necessary for the proper development of spurs and fruiting-wood forming naturally on the tree, together with the removal of the ideal conditions under which woolly aphis thrives.

Many different summer remedies for the control of woolly aphis have been tried from time to time with more or less success. That which appears to be the most satisfactory at the present time is an American nicotine preparation known as "black-leaf 40." This specific is combined with arsenate of lead, and applied when spraying for moth. Oil emulsion diluted to 1 in 60 to 1 in 80, also resin-and-soda compound, have both proved fairly satisfactory (particularly the latter) in keeping the aphis in check until the stronger winter remedies can be used.

For directions regarding black-leaf 40 and resin-and-soda compound see the November issue of the *Journal.*

CULTIVATION.

Every attention should be given to summer cultivation and the destruction of weeds in the orchard. The trees must have moisture during the summer to develop and mature satisfactory crops of fruit. Where irrigation is not practised the orchardist is at the mercy of the weather, and in this direction it is unwise to take

risks in not conserving by means of cultivation all the moisture possible contained by the soil, thus providing against a non-rainy day.

GREEN-MANURING.

Soils that are lacking in humus should be prepared and sown down in a suitable cover-crop for ploughing-in later. This should be done towards the end of February or March. Practically all soils are improved by the addition of humus, particularly very heavy soils, as well as those of a light sandy nature. In addition to rendering such soils more fertile, the moisture-retaining capacity of sandy soils is considerably increased, whilst heavy soils become more friable and readily drained by the addition of humus. (See article on green-manuring by T. E. Rodda in the November issue of the *Journal.*)

THE POULTRY-RUN.

F. C. BROWN, Chief Poultry Instructor.

THE BREEDING-COCKEREL.

Those who commenced hatching early will find it necessary now to select the cockerels for next season's breeding-pens. In this work a mistake is commonly made, breeders pinning their faith to the bird that shows the first signs of early development, such as the one that crows first, the one with the largest comb, &c. Such birds are certainly the first to catch the eye, as they generally have a precocious appearance and a pugnacious temperament. They may also exhibit most of the essential points indicative of a strong constitution. Where the chief disappointment occurs in selecting specimens of this kind is that they never or seldom grow to the desired size. One weakness to be guarded against in much of the utility stock at the present time is decreasing size, not only in the birds themselves but also in the eggs they lay; and it is certainly not the early-maturing cockerel or early-maturing pullet that we must look to for improvement in this direction. If a male is to produce birds to last out a long and heavy laying season and lay decent-sized eggs, he must have some "timber" about him. It is next to impossible for a bird to possess this feature and come to maturity at a very early age.

In speaking of size, this does not necessarily mean that because a bird is well grown he is an ideal breeder. Something more is required. Constitution should be given the first consideration, but type, size, breed-points, and a knowledge of his ancestors must be taken in conjunction. The bird which when from four to five months

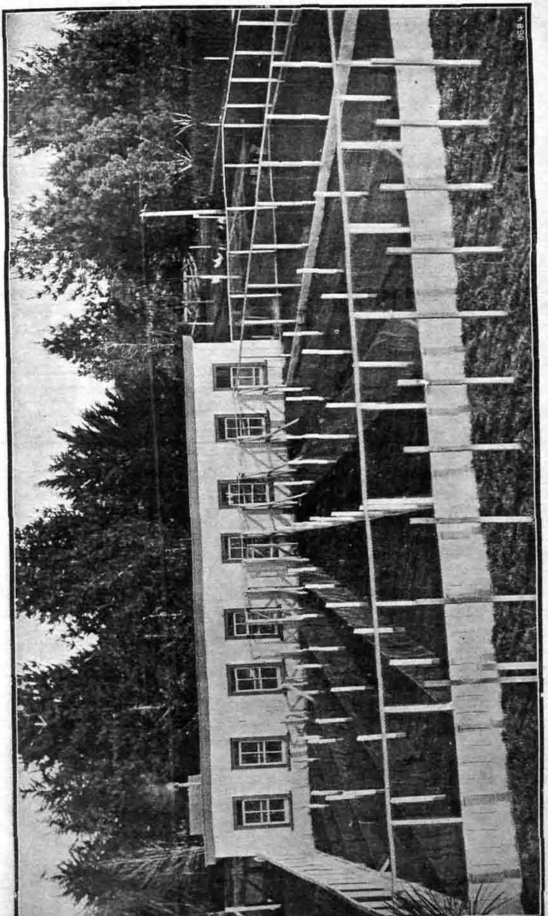
old exhibits a well-grown frame, with good crop and chest development, and at the same time possesses the maximum number of constitutional points, is the one that should be chosen in preference to a bird of the same age that gives evidence of pre-maturity. It is generally considered—and rightly, too—that a good big specimen of the breed is better than a good small one, all other points being equal. As mentioned, however, in Lewis Wright's latest book, breeding for size alone can easily be overdone, and at the expense of the egg-basket. If the weight clauses allotted for the various breeds in the English Poultry Club's standards are adhered to, these will, with a slight reduction in some cases, form sufficient guide for us in the matter of weight.

As to indications of constitution, there is no better guide than noting the bird with a bold prominent eye, a well-balanced frame carried in a proud manner, and standing on flat-boned legs set wide apart, a tightly-feathered plumage, and a distinct masculine appearance. The cowed male, or the one with a feminine appearance, should never be bred from.

The feeding of cockerels intended for the breeding-pen is most important. They can to a great extent be forced to maturity or retarded from it by the method of feeding employed. Only the best of grains should be used, of which a good grade of crushed oats should be liberally supplied. Meat and its substitutes should be sparingly fed, especially where the birds are showing signs of developing at too fast a rate; but there should be an ample supply of green food and charcoal, as well as clean water. Exercise is likewise most important. The breeding-cockerel should have ample range under as natural and healthy conditions as possible.

FEATHER-PULLING.

Many inquiries have reached me lately as to fowls losing their feathers. In some cases it is looked on as an unseasonable moult setting in, and in others the owners of the birds are at a loss to know the cause. It is, however, feather-pulling and nothing else. This is a bad habit, and is usually the result of overcrowding, insufficient exercise, and the presence of vermin, the latter in most cases being responsible. The particular class of parasite that causes this trouble makes its home about the roots of the feathers and causes intense irritation of the skin. The fowl, in order to get rid of the irritation of the insects, may pull out the feathers herself, but generally invites her mates to do so. The mite is so small that it cannot be detected by the naked eye, but if the feathers are closely examined under a magnifying-glass around the edge where the plucking is most noticed they may be clearly seen in the powdery matter at the root of the feathers. There is practically



CHICKEN BROODER-HOUSE AND RUNS, RUAKURA FARM OF INSTRUCTION.

no cure for this trouble, and the only way of fighting it is to prevent it, or, if possible, to remove the cause, for if once the majority of the birds in a flock acquire the habit it is one of the most difficult troubles the poultryman has to overcome. It is commonly stated that an ample supply of animal food, frequent changes of diet, or adding flowers of sulphur or salt to the morning mash will have the desired result. I have seen all these tried, but with no avail. In fact, in the worst case of feather-pulling I ever saw the birds were given as much boiled meat as they could eat at all times.

The only proper treatment of this deplorable habit is to remove the cause, and the first essential is to provide ample range. Where this is available feather-pulling is practically unknown. Constant warfare must be made on vermin by keeping the houses clean and giving them a frequent spraying with a strong sheep-dip. Good dust baths must also be provided, preferably out-of-doors in some sheltered spot during summer and in the corner of the house during winter. Where space does not allow of a good grass run, or where the birds are being kept on the covered-in system and no outside runs are provided, care must be taken to compel the birds to exercise. The floor of the house should be deeply covered with litter in which all grain foods should be fed. This will have the effect of keeping the birds well occupied, which is an essential if the trouble is to be got rid of. When feather-pulling is observed, this being usually first noticed on the neck of a bird, the culprit should be watched for, and, if discovered, it should be isolated at once, as it is apt to teach the vice to other members of the flock.

CLEANLINESS.

Success in poultry-keeping depends upon the manner in which its many details are attended to, but there is one detail before all others which must ever be kept in view, and that is cleanliness. Many people have no idea what cleanliness really means. They seem quite unconcerned if they become covered with vermin every time they enter the fowl-house, even if it be only to collect the eggs. One of my unpleasant experiences—and it is far too common—is to become covered with insect-life on entering dirty houses in order to give advice in regard to the plant and stock. It should not be forgotten that dirt is the forerunner of vermin and disease, and in poultry-keeping disease comes under the category of one of the things that cannot be profitably cured. Very often a little time spent each day in keeping the quarters clean and sweet would in the long-run save much worry, time, and money. There is no better time to fight vermin than now, for it is during the summer months that these natural enemies of poultry multiply to an

alarming extent. There must be no half-measures in this work; it must be thorough.

There are many kinds of insect vermin, but the three to be most guarded against are body-lice, fleas, and red mites. The worst of all is the last named. The red mite is a night marauder, and, owing to its habit of attacking the birds by blood-sucking after dark and avoiding the light of day, it avoids the observation of any but the keen poultryman. A good plan for preventing red mites from making their appearance is to give the inside of the houses a coating of tar, and when thoroughly dry following this by spraying with limewash, which will have the effect of covering up the crevices and hiding-places of the pest. The perches should be frequently washed in some strong disinfectant. The nesting-material should as often as possible be renewed, and in addition given a good dusting with insect-powder. Dust baths, which are nature's remedy, should be provided to enable the birds to rid themselves of body-lice. Even if one is certain that there is no vermin in the poultry-house, it is always a wise plan, as a preventive, to adopt the same measures as if it was present.

THINGS TO REMEMBER.

It should never be forgotten that the male bird is more than half the breeding-pen, and cannot be too well treated.

Early maturity is all very well in its way, but the poultryman can pay too dear a price for it.

When the pullet commences to lay she ceases to grow. Aim at attaining the desired size before the productive period commences.

It is a safer policy to reduce the flock rather than reduce or weaken the ration.

Beware of poor-quality oats, which chiefly consist of husks of no food-value.

THE APIARY.

F. A. JACOBSEN, Apiary Instructor.

EACH successive season demonstrates the dependence of the beekeeper on the climatic conditions. In some localities a uniform honey crop may be depended upon, but unfortunately these favoured spots are few, and more often one good crop in three years is the recompense of much expended labour. However unfavourable the spring and early summer may be, the beekeeper must attend to the strength of individual colonies, and thus be safeguarded and assured of a crop should fickle nature decide later in his favour. Especially in those districts where natural spring feed is lacking should the

wants of colonies be closely attended to, and thus a large force of bees be made available when clover-bloom arrives. The early preparations having been completed, and in many districts the prospects of a good crop being partially assured, there remain the preparations for the gathering of the crop.

EXTRACTING.

The present month is the one when a number of beekeepers commence taking the combs from the hives and extracting the honey. Every apiarist who is working his colonies for the production of extracted honey should be provided with an extractor—2, 4, or 6 framed, according to the number of colonies kept—his other equipment, such as uncapping-tank, knives, settling-tanks, &c. being governed in the same manner. See that everything necessary is arranged for and in position, so that there is no delay when operations commence.

PLACING SUPERS.

In many instances supers may still be required, and the usual method employed is as follows: Place in the super from two to four combs of brood from the brood-chamber, replacing these with empty combs or frames fitted with foundation. This will cause the bees to start work in the super at once. By the time this is finished, however, in the majority of cases a super will already have been added. A second one is probably needed, which is put between the first one in position and the brood-chamber, or, in other words, immediately above the brood-chamber, with the first one on top. If necessary, supers may be added in this manner until the hive is five or six stories high, the new addition generally being placed just above the brood.

TO REMOVE FULL SUPERS.

Presuming that extracting is to be done under favourable conditions, it will not be necessary to worry about robber-bees. The combs of sealed honey should be removed from the super, and the bees brushed or shaken off as quickly as possible before taking them to the honey-house. It is a good method to have an empty super on a barrow alongside the hive, and as the bees are brushed off the combs from the full super the combs are placed in this empty one, which is immediately covered over to prevent any bees getting into it.

Another method is to smoke between the combs, at the same time giving each one several jars to dislodge the bees. If this is repeated twice very few bees will be left, and the super with combs may be removed at once.

A very simple method of ridding the full supers of bees while still on the hive will be found in the use of the bee-escape. This is a board of the exact size to cover the top of a super completely, and into this board is fitted one or more Porter bee-escapes. The whole thing is placed underneath the super you wish the bees to evacuate, and if this is done in the evening and left overnight it is certain, unless brood be there, that very few bees will be left in the super in the morning. These escape-boards are particularly handy to comb-honey producers, but for extracted-honey producers they can be used to advantage only on very warm nights, on account of the honey getting too cold to extract easily the next day.

It is advisable to take off enough supers in the morning to provide employment in extracting for the remainder of the day.

UNMATED QUEENS.

At this season of the year, when the honey-flow is in progress, beekeepers often overlook the work proceeding in the brood-chamber. Strict watch must be kept for queenless colonies, and drone-layers, otherwise unmated queens. It occasionally happens that when a colony has swarmed the weather-conditions prevent the virgin queen left behind flying from the hive to be mated. In such cases, if the delay is prolonged for a fortnight or more, the virgin queen becomes a drone-layer, and cannot, if she would, lay fertilized worker-eggs. Hence the need for a careful watch being maintained over all hives. A drone-layer should be immediately destroyed and a new queen introduced.

THE FARM GARDEN.

W. H. TAYLOR, *Manager, Arataki Horticultural Station.*

VEGETABLE-CULTURE.

IN a former issue some remarks were made by the writer as to the necessity of firm soil. It is not easy for a layman to explain the scientific principles underlying this, but the fact is recognized by experienced cultivators. The mere physical aspect, however, is easily grasped. First, as to seed-sowing: In some districts the surface soil becomes very dry—so dry, in fact, that seed sown in it would not find sufficient moisture to effect germination unless some precautionary measures were taken. If the soil is lying loose it will dry to a greater depth than if firm, provided that it is well broken; moderately firm soil will lose less moisture by evaporation and from the effect of wind than loose soil.

The lesson is obvious. Cultivate well, and then take steps to firm the surface. Small seeds may fail in loose soil through the drying effects of sun or wind, through sinking too low in the soil, or through the young rootlets being unable to get a grip on the loosely lying particles of soil, and so being unable to find nourishment. The feeding-roots are extremely minute, and it is necessary that they be surrounded by fine soil in a moist state. Seedlings do not take sustenance from the soil until they have developed foliage. Previous to this the young plant is fed from a store of food contained in the seed. In the case of small seeds the supply of food is infinitesimally small. If the seed is too deep in the ground this supply of food will be exhausted before foliage is developed, and the seedling dies. If the surface soil were made firm previous to sowing there would be few failures—many ascribe to bad seed failures that have been due to lack of this precaution.

When plants have attained some size they may still be prejudicially affected by loose soil, by want of proper contact of the fine feeding-roots with the particles of soil, and also by undue drying of the soil from atmospheric causes. It is advisable at this time to avoid deep cultivation—merely the surface soil should be kept loose. This being kept frequently moved will not contain any roots, and will act as a mulch to the moister soil below.

Most of the winter vegetables are now in the ground, or should be. Finish planting *broccoli, savoys, cabbages,* and *Brussels sprouts* as soon as possible. In the warmer parts of the Dominion this will sometimes be delayed by lack of moisture. In those districts some success is secured by planting later than in most parts—to which the above remarks chiefly apply. During February the winter supply of *spinach* should be arranged for. Sow a good breadth, for the plants will stand till late in spring, and will require thinning. *French beans* may be sown early in the month in all but the coldest places. Keep the crops of *runner beans* closely gathered, and they will continue to bear until stopped by cold weather. Late crops of *peas* should be supported by sticks if possible. If they lie on the ground when moist weather and shorter days come they become a prey to mildew and damping of the haulm and pods. *Silver-beet* may still be sown with advantage.

Marrows, pumpkins, and all that tribe have a habit of throwing out very strong runners. These should be stopped to cause lateral growths, which will bear plenty of fruit.

Attend closely to the stopping and tying of *tomato* plants; left to themselves they persistently throw out side-shoots. These are waste; they rob the soil of moisture and the fruit of strength. These shoots should be suppressed as soon as they are formed.

Blight may have been absent up to now, yet in moist situations it is most likely to appear as weather-conditions become moister. A spraying with 4-4-40 Bordeaux as a prevention would be wisely given, for the blight works very rapidly when it appears towards autumn, and may quickly cut off a crop in its prime.

Turnips may be sown, and *onions* for salading. Sufficient cultivation should be done to maintain a loose surface between all growing crops. A little dry helebore-powder dusted into the hearts of young plants of any of the *brassica* family (cabbages, &c.) affords a great protection against the caterpillars that prey on them. The heart of the plant is its vulnerable point. If this is saved the plant is enabled to outgrow the ravages of the pest. A dressing of nitrate of soda, 2 oz. per square yard, will, if rain supervenes, give a filip to growth. Spray *onions* with 2-2-40 Bordeaux as a preventive of mildew.

SMALL FRUITS.

Raspberries.—As before pointed out, the crop largely depends on the production of strong, well-ripened canes. To get these it is necessary to give them room. They require sun and air, and to be free from the competition of a crowd of useless canes. The canes bear only once, and then die. Obviously the canes are useless when the crop is past, and then is a good time to cut them out. The young canes will be relieved from the competition of the old ones, and have more room to finish their growth. This is becoming a universal practice.

Strawberries.—Where runners are being grown for future planting they should be restricted in number. To allow the runners to ramble on at will means the production of a large number of poor little plants. Well-grown plants will provide a corresponding good crop next season, instead of having to waste time while they grow to fruiting size.

Gooseberries.—If there are signs of the leaf-spot disease the bushes should be well sprayed with 4-4-40 Bordeaux mixture.

Loganberries.—It is a mistake to think the rods fruit only once. They will fruit twice, and in some instances it is desirable that they should be left for that purpose. There is not at all times enough young rods to properly furnish the space; in that case some year-old rods should be left. All the bearing-laterals on these rods will require spurring back in winter where sufficient young rods are made; all the old may be cut away as soon as they have done fruiting.

Red and White Currants.—If young growth has not been attended to as advised last month, do it at once; it pays.

FLOWER-CULTURE.

Carnation layering should be completed as soon as possible, or the advantages of this manner of increase are lost. Layering while the plants are in growth means quick rooting, which gives ample time for development of strong plants, with a corresponding good crop of flowers next season. The layers will not root unless an incision is made to form a tongue. The roots form on the tongue only. The young grass may be layered separately, or the cut may be made in older wood having several young shoots above it. This method is sometimes convenient when the grass is short and closely bunched together. Of course, the young plants from such layers are larger than those from single shoots; they are quite satisfactory. When the shoots or pipings are separated from the parent plant and put in as cuttings it is usual and advisable to cut off the tops of the grass. This should not be done with layers, or they will be longer making roots.

Where it is desirable to increase good varieties of *verbena* the shoots should be pegged down with wire pegs. Every joint kept in contact with the soil will take root, and can be removed in autumn or later at convenience. This is a very easy mode of increasing the stock for bedding or such purposes. The amount of labour required is very trifling, and it ensures purity of stock. As showing its possibilities, I may say that we had here last summer two plants of desirable colours. They were pegged down and gave us fifty-six and sixty-four plants respectively.

Wallflowers should be sown at once if not already sown. To give satisfaction they require time to make growth, so as to be good plants when they flower in early spring. It is best to give the plants two shifts before final planting. Prick them off into boxes as soon as they can be handled. When they have filled the boxes transfer them to a nurse-bed in the open ground. Here they will continue to improve until the beds they are to occupy have been cleared of their summer occupants.

Sowing biennial plants may be undertaken now, though in most cases next month will be time enough, for which reason priority should be given to perennials, many of which are easily got by seed—*Erica arborea, swainsonia, Clianthus puniceus, mandevilla,* some of the *bignonias, everlasting peas* such as Pink Beauty, *Lathyrus pubescens* (blue and the white species), *columbines, delphinium, carnations, gerbera, primroses, polyanthus,* and many others. *Violets* are liable to be attacked by red spider. When this occurs the best plan is to cut all the leaves off and burn them or bury them deeply in the ground. The new crop of leaves will come clean.

ANSWERS TO CORRESPONDENTS.

IN every instance a question to which an answer is desired in these columns must be accompanied by the full name and the postal address of the inquirer, not necessarily for publication, but as a guarantee of good faith. The question *should be written on one side of the paper only.*

FAILURE OF CONCEPTION IN COW.

"JERSEY COW," Canterbury :—

I have a purebred Jersey cow that failed to get in calf last year. She was the first cow of a herd of twenty-four to take the bull; all the others proved in calf but her. When she came back the first time I washed her out with lysol, 100 to 1. She took the bull at regular intervals of twenty-one days four times, and by that time it was too late in the season, so I decided to milk her on and try her again this spring. Twice last winter while in heat I washed her out with the above mixture. I tried her again this spring with a different bull, and still she does not hold. A little yellow discharge comes from her about twenty-four hours after she has taken the bull. She is eight years old, in good milking-condition, and has had five calves. I have taken her to the bull on a halter and kept her moving about for an hour after being served.

The Live-stock Division :—

Apparently some organic alteration in the genital organs occurred at or since your cow's calving, and the fact that she has failed to conceive at her frequent matings must be attributed to that cause, and not abortion, vaginitis, or incompetence on the part of the bulls. What the condition is it is difficult to say. It might be found by carefully examining the cow. To do this, however, it is necessary for the examiner to be acquainted with the natural conditions of the organs in order to detect any difference. The most important part to examine is the cervix uteri, or mouth of the womb, as this is the part most commonly implicated. In some cases it is rigid and displaced, and in others it is occluded altogether, so that the semen cannot enter the uterus. If this is the case, the oiled hand should be passed into the vagina and gentle dilation by the fingers attempted. A little belladonna ointment smeared on the part will help. This should be done an hour or so before the cow is taken to the bull. There are numerous other conditions preventing conception, such as tumours, &c., which may be detected by examination. If possible, however, have the animal examined by a qualified veterinary surgeon. We do not think you will do any good with lysol injections. You, however, might try the injection, about an hour before service, of a solution of bicarbonate of soda, 2 oz. to the quart of lukewarm water. This will counteract any acidity of the mucous secretion, which sometimes prevents conception by destroying the spermatozoa.

PIG-FEEDING.

F. SCHWIETERS, Waitara :—

I am at present feeding my pigs on skim-milk and molasses, but will have to start feeding a little grain as well. I have about ten sacks of peas, and am thinking of having them ground into meal and mixed with, say, four sacks of pollard and two sacks of bran. Would it be advisable to feed a mixture such as this, or would you rather advise feeding just the peas whole along with the milk and treacle?

The Live-stock Division :—

It will be best to have the peas ground, although it will add a little to the expense. The pigs should do well on the mixture proposed.

HAND-REARING OF FOAL.

"SUBSCRIBER," Takaka :—

I have a foal whose mother died just after foaling. I am not sure if it sucked its mother at all, but it is living all right. I am giving it cow's milk and water. Will you please give me all particulars as to the best way of feeding the foal—the kind of food, how often to feed, &c.?

The Live-stock Division :—

Rearing a "caid" foal is a troublesome business, but there is no doubt if you will take the trouble you will rear it. It is the first few days that are the most bother. Mares' milk contains more water and also more sugar than cows' milk, and for all practical purposes one quart of cows' milk, a gill and a half of warm water, and a teaspoonful of raw moist sugar would be about the proper proportion to give. The foal should be fed at least every two hours to begin with, and the last meal should be given at midnight. If he is a draught foal he will probably drink a quart at a meal, or perhaps more. About 7 to 8 quarts a day, however, are sufficient. As soon as he will take them, which will not be for a few weeks, give him some dry crushed oats. Let the foal run out on good pasture in good weather, bringing him in at night, and also keeping him in if the weather is cold and wet. Foals will stand cold, but not cold and wet. It is better to take the cows' milk for feeding him from the bulk; it is more likely to be of an average composition than if you got it from a single cow. Keep all feeding-utensils scrupulously clean. Particular attention should be paid to the bowels, and if you notice either diarrhœa or constipation give the foal 1 oz. of castor-oil with a dessertspoonful of gin and a little peppermint. A gill of lime-water may be given in his milk twice a day (the clear water on the top when quicklime is slaked). Hand-reared foals are very subject to worms, and if you find the animal not doing well—pot-bellied, with a dry staring coat—you may conclude he has got parasites. The reason for this is that such foals are always nosing around the homestead, drinking stagnant water, &c., which contain the eggs of the worms. It is, therefore, the best plan to put the foal on a good sound pasture, where the water-supply is good.

FRUIT-TREES ATTACKED BY GIRDLER BORER.

"W. H. M.," Hunterville :—

During the last two years I have had a number of fruit-trees seriously damaged by a species of borer which makes a groove almost completely round the tree, and at the centre of the arc there is a hole going into the tree about as thick as a lead-pencil. I have never been able to find the actual grub, though I once found an empty chrysalis-case about 2 in. long. The mischief is always done before the thing is discovered, and the limb affected generally dies. I shall be glad if you will tell me what is the cause of the trouble, and how to combat it.

The Horticulture Division :—

The species of borer attacking your trees is commonly known as the "girdler." At times a considerable amount of damage is done both to fruit and other trees by this insect. There is no real practical remedy known for the control of this pest other than destroying the larvæ and chrysalis when found. Squirt a little benzene into the hole in the limb made by the grub, and plug it up with soap. This will in most cases have the effect of destroying the grub within.

HOVEN IN LAMBS.

WM. A. DAWSON, Fortrose :—

I unsuccessfully tried to save a young lamb which had wind inside so badly as to be blown up, and I would like to know if there is any sure cure. The lamb got so bad that I killed it; when opened up there was just grass in the stomach, which I suppose caused the wind. The rest of the intestines seemed to be full of wind, but otherwise fairly empty; the bowels seemed free. I at first gave the lamb a dose of baking-soda and Epsom salts, then later an injection, but could not reduce the trouble. I would like to know if there is any sure cure.

The Live-stock Division :—

Hoven is not generally considered a serious trouble in lambs. Very little of it occurs on ordinary pastures, and then it is usually when the lamb is beginning to supplement the mother's milk with herbage, and the fore compartments of the stomach are adapting themselves to the new kind of food. Cases of hoven generally occur with a shower of rain after a dry period on pastures where white clover is prevalent. If the animals are blown up pretty badly, no time should be lost in getting them off the clover on to some barren ground. Treatment is not necessary; the exercise caused by moving them seems to help to move on the gas, and they are soon all right. With regard to your lamb there is no doubt that the trouble was due to gas, though it would appear that the ewe was not doing the lamb as she should have, or else you would have found evidence of milk when you made the *post-mortem*. With regard to treatment, it is little use bothering with a lamb; you cannot practically use a trochar and liberate the gas through the flank. An ounce of castor-oil shaken up with a dessertspoonful of gin, and given in a little of the mother's milk, would be about the best of things to give. Injections are of no use.

COW-TESTING APPARATUS.

"A. E. C.," Miranda :—

Could you let me know what apparatus is required for testing my cows for butter-fat, and where to get it?

The Dairy Division :—

The most satisfactory method of testing dairy cows is to weigh the milk on a scales or spring balance, and take a sample from four milkings about the middle of each month for fat-determination by a Babcock tester. The requirements are: A 4 oz. sample bottle (with cork) for each cow; a Babcock tester—size according to number of cows in herd; Babcock bottles; 2 x 17·6 c.c. pipettes; 1 acid-measure; thermometer; 1 gallon commercial sulphuric acid, specific gravity 1·825. The requisites may be procured from any dairy-supplies firm. Leaflets on the subject have been forwarded to you.

CROPPING BURNT-OFF FERN LAND.

"RUATUNA," Bay of Plenty :—

I have 20 acres of raw burnt-off fern land, good deep black soil, on deep sandy loam subsoil. The usual method of breaking in such lands in this district is to start with a crop of swedes, but I cannot do that this season. What chance would I have of a fair crop of oats for chaffing, by summer fallowing the land and sowing the oats, say, in May next? Please advise method of cultivation for this purpose, and manure to use.

The Fields Division :—

It is assumed you can plough the land. If so, plough early about 6 in. to 9 in. deep, and let the ground be exposed to the sun and air all summer, working it up well with disk (once or twice) and tine harrows, starting about end of March or beginning of April. Seed Algerian oats, about 2½ bushels per acre, in May, using with the seed about 2 cwt. per acre of basic superphosphate. Roll the oats when about 3 in. high, to provide good fast hold and to encourage stooling. This should provide a good crop of oats for chaffing—to be cut between early and mid summer.

LIME FOR PIGS.—HOLDING FOR CASTRATION.

"EXPERIMENTER," Ohapuku :—

We have read of giving precipitated chalk to pigs to supply lime. Is this advisable? If so, can it be obtained, and at what price? What would be a sufficient quantity to give?

What is the correct way to hold young pigs for castrating?

The Live-stock Division :—

It is not advisable to give precipitated chalk to pigs to supply lime. Chalk is the carbonate of lime. What should be given is a phosphate, and if you substituted precipitated phosphate of lime for the chalk that would meet the case.

When castrating pigs the operator should stand against a low wall or fence, so as to give him steadiness, having his legs a little open. The assistant holds the pig, one hind leg in each hand fairly wide apart, the pig's back away from him. He then pushes the pig towards the operator, who receives it between his legs and grips it with his knees. The assistant at the same time presses against the pig's brisket with his knee, and also holds the hind legs well up with firm wrists, pressing the pig well in towards the operator. By this method the pig is firmly held, and the testicles can easily be manipulated.

SOWING LUCERNE IN CANTERBURY.

W. BURT, Dallington :—

I would like to know the latest date advisable to sow lucerne in the autumn in Canterbury.

The Fields Division :—

It is not considered advisable to seed lucerne in Canterbury later than the end of February or the beginning of March, so that the crop may make fair growth before the frosts of winter set in.

USE OF HYDROMETER WITH HONEY.

STEPHEN ANTHONY, Coromandel :—

Mr. Hopkins used to advocate the use of the hydrometer, but he never explained how the degree of moisture in the honey is to be deducted from the reading of the hydrometer; and that is what I should like to know. Thus, for instance, the hydrometer sinks into the honey to the mark 149½. What is the moisture present in the honey, and how is that to be found?

The Horticulture Division :—

The figures mentioned by you—viz., 149½—indicate that you are using the wrong hydrometer. "Twaddles" No. 4 is the one found most convenient, and this has a range of from 72° to 102°, each degree being equal to 5° specific gravity. For example, 85° (No. 4 Twaddles) is equal to 1,425° specific gravity, as $85 \times 5 = 425$, and $425 + 1000 = 1{,}425°$ specific gravity. Thus we ascertain the specific gravity or density of the honey, and it is by becoming familiar with this that the ripeness or otherwise can be gauged. It has become known that the higher the specific gravity the riper the honey, and that honey with a specific gravity of less than 1,410° is unsuitable for market.

As to ascertaining the percentage of moisture in honey by the hydrometer, this can only be done by comparison. The proper method is to evaporate and condense the water in a given quantity of honey; but this requires special skill and practice in addition to the appliances, and on this account cannot be undertaken by the beekeeper.

POOR CLAY LAND.—DANTHONIA.

"X. Y. Z.," Orini :—

Will you kindly give me the following information: What is meant by "strong clay of poor quality"? Does "strong" mean heavy, and is it good to have sandstone formation under clay? Is there any grass that can be surface-sown on such land, to give one a start until such time as it can be ploughed? What kind of grass is danthonia; do cows thrive on it?

The Fields Division :—

"Strong" usually implies a soil that is heavy in texture, and at the same time contains an abundance of organic matter (humus), in contradistinction to a soil light in texture and usually lacking in humus. Thus "strong" embodies both heaviness of texture and richness in quality, due to the contained humus. A soil, however, may lack somewhat in humus. Such would be a heavy clay, which, strictly speaking, should not be referred to as a "strong" soil. A "strong clay of poor quality" is evidently meant to refer to a heavy clay low in humus-content. Certain heavy clays, however, contain a fair supply of humus, as indicated by the darkish colour. Clay over sandstone is not considered a good formation, owing to the tendency of such soil to dry out in a dry season. If the sandstone does not appear before a considerable depth is reached the formation is then all right, for then there is sufficient depth of clay to retain moisture and to provide satisfactory capillarity (movement upward of water).

For the soil in question you had better use a mixture consisting of: Cocksfoot, 8 lb.; *Poa trivialis*, 3 lb.; crested dogstail, 3 lb.; *Danthonia pilosa*, 3 lb.; browntop, 2½ lb.; hard fescue, 2 lb.; *Poa Brownii*, 1 lb.; white clover, 1½ lb.; alsike, 1½ lb.; *Lotus angustissimus*, ½ lb.: total, 26 lb. per acre. This mixture should give you fairly satisfactory results.

Danthonia pilosa is a native grass of second-rate value, but suitable for sowing on poor country where better grasses will not thrive. It is very persistent where established, and will stand burning off where fern is so treated. Alone it would not be suitable for dairy cows, being more suited for sheep. In a mixture it should provide fair feed, provided the mixture takes a hold of poor soil.

SPRAY FOR NOXIOUS WEEDS.

"W. A. M.," Waikiekie :—

Would you kindly inform me what are the best makes of noxious-weed destroyers, and which kind is least likely to injure or poison animals when sprayed about the paddocks; also about what month is best to spray?

The Fields Division :—

A good spray for blackberry and briar is made of: 3 lb. arsenic (crude), and 2 lb. caustic soda, mixed in 3 gallons water and boiled until dissolved. To spray, use 1 gallon to 10 gallons of water. This should be applied in dry weather, as rain spoils the effect. After application the plant can generally be burnt in about two or three weeks. After burning apply more of the mixture to the roots. As this mixture is poisonous, care must be taken not to allow stock access to the plants till after burning, or until after heavy rain.

SORES ON COWS' TEATS.

"R. P. S.," Paeroa :—

I have constant trouble every spring with skin-sores on cows' teats, especially heifers. The trouble is different to white pimples of cow-pox, and affected one cow so badly that I could not milk two quarters for two days, and had to use metal tubes to draw milk off, with bad results. I have tried various applications, composed of vaseline for the most part. Could you recommend a good dressing for the teats to help heal and to rub on after milking as a safeguard? Would an ointment made of lard be better than vaseline dressings?

The Live-stock Division :—

We should advise you to use a boracic ointment made up of boracic acid 1 oz. and fresh lard 8 oz. Apply a little ointment whilst milking and after milking. The teats should be kept clean with warm water to which is added a little boracic powder. In these cases an ointment made with lard is better than one made with vaseline.

SLUGS TAKING YOUNG RAPE.

"INQUIRER," Manaroa :—

This year we have had great difficulty in growing early rape. We find that when the seed has just sprouted above the ground it is eaten off by slugs. Can you suggest anything to kill these pests, or to stop them eating the plants for a week or two after germination ?

The Fields Division :—

The only feasible method of dealing with the slugs is to top-dress with quick-lime, at the rate of about 1 ton per acre, during the time the rape is coming through the ground or very soon after. The application of lime will also greatly improve the ground, which doubtless is sour.

COW SUCKING HERSELF.

"SUBSCRIBER," Manakau :—

I have a valuable cow that sucks itself. She will even drink the sour pig-milk if given the chance. I have tried a spiked halter, also a bar between the legs, but both these I had to discontinue owing to soreness. I also tried rubbing bitter aloes on the teats, but to no purpose. Can you suggest anything else that I could do ?

The Live-stock Division :—

A cow that milks herself is just about as bad a nuisance as you can get, and unless she is a pedigree animal and valuable for breeding purposes the best thing to do is to make her into beef. Apart from a muzzle, which has the disadvantage of preventing the cow from grazing, we have found the best appliance is an ordinary necklace or "cradle," of the same pattern as put on horses when fired or blistered. A rough sketch and description of this appliance have been forwarded to you. The idea is to allow up-and-down movement of the head, but if the cow wants to put her head too far to one side the bars acting between the jaw and the shoulder prevent her from doing it.

DANTHONIA.

"W. T.," King-country :—

Would you please inform me whether danthonia, if sown on a poor spur, will spread on to rich good grass land adjoining ; that is, would it spread sufficiently to reduce the carrying-capacity of the good land ?

The Fields Division :—

Danthonia will not spread in the manner suggested by you.

RECIPE FOR CIDER VINEGAR.

"SUBSCRIBER," Whangarei :—

Would you kindly inform me the best way to make cider vinegar ? I am getting a cider-press.

The Horticulture Division :—

Crush the apples as finely as possible, and then press well until all the juice possible has been obtained. Take specific gravity : it usually shows an average reading of 1,050. This is not as a rule sweet enough to make a strong vinegar, and it is advisable to add at least 1 lb. or more of sugar to the gallon of cider until the specific gravity is 1,080. Allow to ferment until dry—*i.e.*, when specific-gravity instrument shows a reading of 1,000. Rack off into another cask, only filling it two-thirds full. Let this stand until a thick scum forms. Be sure not to disturb the scum ; after some weeks it will settle to the bottom. When it has entirely disappeared the vinegar will be ready for use. If a tap is used, insert it at least 3 in. above chime of cask. Be sure that a wooden tap is used.

COMMERCIAL INTELLIGENCE.

AMERICA AND BUTTER EXPORTS.

UNDER date the 17th November, 1915, Mr. E. Clifton, New Zealand Commissioner at San Francisco, writes as follows :—

Among new markets that have been sought for New Zealand butter is that of San Francisco. It is, however, more than probable that there will be no place for our butter in California, for the very especial reason that this State should *immediately become a regular exporter of that product.* There are many conditions that have brought about an increase of dairy-farming in California. The climate permits of a more economical dairy-farm management than is possible in other States farther north or those to the eastward. Careful stabling for the winter is unnecessary here, and irrigation has brought into use quite large areas that are now in alfalfa (lucerne), while the institution of cold-storage has practically obliterated season. The opening of the Panama Canal, with vessels now trading direct from San Francisco to New York, has considerably cheapened transport. This year there will be a surplus of upwards of 3,500 tons of butter. This must be exported. The cities of the east provide markets of enormous capacity, and the prices are also much higher than can be obtained here. New Zealand will therefore realize that it can be only in special seasons and when an occasional shortage occurs, giving the promise of a profitable market, that butter will be imported into California. Such a market—merely a spasmodic one—cannot be a satisfactory outlet for our product. Some months ago, when prices in Australia became abnormally inflated, about 1,350 tons of butter was exported from California to the Commonwealth. It was encouraging to the Californian dairy-farmer that such an exportation could be made, but this again was but spasmodic, and brought about through the unfortunate conditions attending the drought in Australia. There came with this trade, however, a very sharp lesson to the butter-makers of California. Their product did not meet with appreciation in Australia. It was of poor quality, and by no means even. It is, indeed, said that some of this butter could not be sold in Australia on account of its quality, and that it was shipped on to London. That may or may not be true, but it is quite certain that the butter was of poor quality and of many varying grades, and was made up of different lots collected for that particular emergency.

There is in this a lesson to our own dairy people. It is unfortunate to see second-grade butter exported into Canada. This was observed last year, second-grade butter being landed in September that was graded in New Zealand in March, *with, moreover, the boxes stained and unattractive. The butter was followed* into the warehouse of the importer, and there it was found to be very decidedly secondary quality. Now, this butter when set out in the market is simply described as the product of New Zealand, and this cannot but fail to have a very detrimental effect on the popular estimate of New Zealand butter.

Just now, in view of the fact that California will become an exporter, very great efforts are being made by the dairy associations, and by the Bureau of Agriculture and the University of California, to impress makers with the fact that even though they may have a large quantity of butter to export they are but impeding the establishment of markets if quality is not carefully maintained. These institutions are assisting the dairymen in every direction with advice and instruction.

In the writer's opinion, therefore, we should endeavour to assure that only butter of the first grade is exported to Vancouver, and that we should be still more careful when the Dominion commences to exploit the markets of the eastern States of the United States. It is there that the great consumption of food products is centred. It is in the east that the great cities and immense manufacturing interests of this country are situated, and the Panama Canal affords a direct means of exporting our butter to markets on the east side, to which, it is submitted, New Zealand should at once devote its attention.

IMPORTED EGGS IN UNITED STATES.

THE New Zealand Commissioner at San Francisco, Mr. E. Clifton, sends the following communication, dated the 15th November, 1915:—

New Zealand poultrymen were somewhat exercised lately over the extent of the importation of eggs from the United States to the Dominion. It was, after all, but a comparatively small business. They may be interested to learn the extent of the importation of Chinese eggs and egg products into this country.

In Hankow there are operating four firms whose business is the preparation of desiccated eggs. There are stated to have been exported to America during 1914 3,057,128 lb. of eggs so prepared. There were also exported from Shanghai to the States 3,600,000 dozen eggs. The enormous number exported has not largely increased the value in China. The rate ruling there to-day is said to be the equivalent of 1s. 5½d. per hundred.

In view of the big importation, some endeavour has been made by the American authorities to ascertain the conditions under which these eggs are produced. It is found that there are no farms in China devoted to the breeding of poultry, that hens are owned by almost every householder, that they are the scavengers of the village and the farm, seldom are houses provided for them, and that eggs are produced under the most insanitary conditions.

Certain State enactments have been made here imposing drastic restrictions on the sale of imported eggs. Although this is definitely law, it has not yet been enforced, and probably will not be, the provisions having been declared untenable by the Judges of several Courts. It is claimed that the importation has been somewhat restricted during the present season, but statistics are not at present available.

It is rather interesting to observe the varying descriptions of eggs that are set out by the great packing-houses. Among them may be mentioned "Select breakfast eggs," "Guaranteed eggs," "Strictly fresh," "Fancy select, guaranteed," "Every egg guaranteed," "Selected guaranteed," "Guaranteed ranch," "Candled," and "Ranch." When the final description, "Ranch," is set out without any qualification, it may be accepted that the quality is far from desirable. The Inspectors under the Pure Food Regulations are undoubtedly active in the exercise of their duties. It seems, however, impossible to obtain the assistance from the law-courts that might be expected to be extended to those who are endeavouring to place a reasonably pure food before the consumer.

Many of the eggs mentioned are from cold storage. This cold storage is under careful supervision. In the greater number of the States food cannot be retained in the stores over a certain time. It would be immensely to the benefit of the consumer if this could be always assured, but it is claimed that again and again, although in the warehouses themselves the date of the reception of goods for storage is marked—indeed, plainly stamped on the package—before the consumer is reached every means of identification has been removed.

British Trade Fair.—H.M. Trade Commissioner advises that the Board of Trade will hold a British Trade Fair at the Victoria and Albert Museum, in London, opening on the 21st February, for twelve days. The fair will be run on the same lines as the previous one held last May, which was modelled on the Leipzig Fair, and proved very successful. It will partake of the nature of an exhibition of samples of British manufactures for the purpose of placing contracts, and will be limited to the following classes: Toys, fancy goods, china and earthenware, glassware, printing and stationery. Buyers are requested to communicate direct with the Board of Trade, British Industries Fair, 32 Cheapside, immediately on arrival in London.

THE Municipality and Chamber of Commerce of the City of Lyons, France, are organizing an annual sample fair on the lines of the Leipzig institution, to be held from the 1st to the 15th March, commencing this year. The chief object is the development of French industries, particularly as affecting articles hitherto monopolized by enemy countries. The fair will be open to merchants and manufacturers of the allied and neutral countries.

ACREAGE UNDER CROPS.

The following table, compiled by the Government Statistician from returns collected through the post in October, November, and December, shows the acreage of grain, root, and other crops sown or intended to be sown this season (1915–16). The figures may be taken as a fairly accurate estimate of the areas under the respective crops.

District.	For Threshing only.					Intended to be cut for Seed.						Sown or intended to be sown this Season.			
	Wheat.	Oats.	Barley.	Maize.	Peas.	Rye-grass.	Cocksfoot.	Red Clover.	White Clover.	Other Clover.	Chewings Fescue.	Potatoes.	Turnips.	Mangels.	Rape.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Auckland	3,008	14,614	2,008	6,461	366	7,079	5,139	332	292	493	133	5,465	100,951	1,519	20,739
Taranaki	1,226	3,286	679	34	51	197	255	..	..	..	..	671	28,481	1,520	5,666
Hawke's Bay	1,441	7,514	2,661	629	62	6,286	497	5	63	3	..	495	18,156	437	20,639
Wellington	10,938	17,721	1,548	65	431	3,017	1,283	184	39	10	..	2,157	35,453	1,093	28,205
Marlborough	5,502	6,244	7,738	1	2,670	464	293	421	44	40	..	483	4,573	477	5,755
Nelson	8,306	8,933	1,887	20	357	409	671	200	18	3	78	1,105	15,265	312	8,867
Westland	..	153	..	..	..	46	215	10	55	4	..	131	2,395	2	209
Canterbury	245,555	165,689	8,419	19	5,663	11,648	10,332	1,274	545	51	301	10,073	146,552	4,634	80,555
Otago—															
Otago portion ..	48,462	73,384	4,456	..	412	8,878	574	138	42	7	30	3,257	114,299	1,423	22,082
Southland portion ..	8,795	82,331	407	..	29	17,124	704	3	4	4	..	1,994	108,078	17	10,564
Totals, 1915–16 ..	333,233	379,869	29,803	7,229	10,041	55,148	19,963	2,567	1,102	615	542	25,831	574,203	11,434	203,281
Totals, 1914–15 ..	229,600	287,561	18,347	5,477	13,304	50,533	17,551	5,702	1,458	860	7,158	21,887	514,105	9,691	197,114

NEW ZEALAND EXPORTS TO BRITAIN.

COMPILED FROM MANIFESTS OF VESSELS SAILED DURING RESPECTIVE MONTHS OF CURRENT AND PRECEDING SEASONS.

Month.		Mutton, Carcases.	Lamb, Carcases.	Beef, Quarters.	Pork, Carcases.	Butter, Boxes.	Cheese, Crates.	Wool, Bales.	Wheat, Sacks.	Oats, Sacks.	Rabbits, Crates.	Hemp, Bales.	Tow, Bales.	Kauri-gum, Pkgs.
January,	1915	137,816	296,439	45,622	339	138,081	85,123	87,393	..	..	2,860	683	..	1,209
"	1914	231,766	464,185	30,424	33	150,492	136,086	108,742	..	500	2,851	15,234	4,306	11,133
February,	1915	433,585	517,581	77,421	311	119,371	96,090	159,347	..	..	..	13,111	6,619	2,763
"	1914	354,190	334,207	14,100	3	86,570	59,532	127,372	..	4	..	3,709	633	7,607
March,	1915	80,439	203,480	30,176	..	55,280	51,811	49,809	..	..	..	8,410	185	274
"	1914	446,522	551,313	36,689	..	61,060	62,732	95,175	..	..	..	8,187	2,562	3,958
April,	1915	286,155	328,779	45,340	..	6,703	38,561	41,371	..	..	1,011	9,328	1,474	3,461
"	1914	234,765	366,786	22,185	..	7,822	63,796	58,488	..	2,901	..	1,247	888	5,909
May,	1915	257,953	433,831	34,780	655	148	17,065	21,615	..	..	2,923	4,968	808	2,636
"	1914	336,632	638,397	39,315	54	837	37,776	43,364	3,623	11,062	..	8,355	2,112	9,316
June,	1915	99,080	154,785	19,316	932	..	26,869	11,946	..	..	9,800	5,027	1,320	1,229
"	1914	261,877	634,981	36,400	..	1,153	19,247	18,774	..	28,141	1,000	7,924	4,258	7,881
July,	1915	243,420	340,476	21,231	154	..	21,520	16,039	..	..	5,968	5,068	1,639	4,184
"	1914	225,411	239,143	38,170	..	1,355	2,003	15,868	..	1,425	1,000	5,810	2,584	8,053
August,	1915	510,418	570,381	51,750	35	..	18,287	19,416	..	..	31,790	7,138	1,466	4,848
"	1914	84,251	63,111	19,094	516	1,979	50	4,845	600	38,220	10,403	367	245	3,705
September,	1915	299,715	330,643	59,487	..	26,416	2,595	5,360	..	..	7,750	2,022	3,091	595
"	1914	53,386	49,200	2,353	..	15,885	..	3,337	..	5,896	7,288	1,143	57	..
October,	1915	367,198	417,794	87,104	..	111,468	49,160	7,272	..	..	56,636	5,650	1,645	1,230
"	1914	291,432	128,016	49,104	..	81,842	30,487	8,938	..	68,660	38,121	2,042	1,650	1,683
November,	1915	93,777	92,601	21,609	..	81,102	47,243	18,715	..	..	13,538	5,064	1,789	868
"	1914	136,346	27,577	48,302	27	98,729	70,048	37,604	15	24,289	35,783	885	110	1,377
December,	1915	91,124	59,231	36,467	..	214,967	81,939	33,527	..	..	3,052	6,016	1,940	5,555
"	1914	192,952	149,835	44,876	..	172,990	80,144	86,317	..	..	9,306	1,136	116	2,157

LONDON MARKET VALUES.

COMPARATIVE STATEMENT COMPILED *FROM THE HIGH* COMMISSIONER'S CABLES FOR THE PAST THREE MONTHS.

London Date.	Wool. Bradford Quotations for Tops. 36's.	40's.	44's.	50's.	56's.	60's.	Mutton. Canterbury.	Mutton. North Island.	Lamb. Canterbury.	Lamb. Other than Canterbury.	Beef. New Zealand Hinds.	Beef. New Zealand Fores.	Butter. Danish.	Butter. New Zealand.	Cheese. New Zealand White.	Cheese. New Zealand Coloured.	Cheese. Canadian.	Hemp (Spot). New Zealand Good-fair.	Hemp (Spot). New Zealand Fair.	Hemp (Spot). Manila Fair (New Grade).	Hemp (Forward Shipment). New Zealand Good-fair.	Hemp (Forward Shipment). New Zealand Fair.	Hemp (Forward Shipment). Manila Fair (New Grade).	Wheat. Short-berried.	Wheat. Long-berried.	Oats. Sparrowbills.	Oats. Danish.
							d.	d.	d.	d.	d.	d.															
1915. Oct. 9	..	..	..	..	..	..	7⅜	..	8⅛	7⅞	..	..	207/0	..	76/0	77/0	77/0	33/0/0	31/0/0	38/0/0	..	..	..	..	..	..	..
„ 16	..	..	..	..	..	..	7⅜	..	8⅛	..	6	5	187/0	..	77/0	76/0	78/0	33/10/0	31/10/0	38/10/0	33/0/0	31/0/0	38/10/0	..	..	..	..
„ 23	..	..	..	..	..	..	7⅜	..	8⅛	8⅛	6	5	160/0	..	..	..	84/0	33/10/0	31/10/0	40/0/0	33/10/0	31/10/0	40/0/0	..	..	..	..
„ [illegible]	..	..	..	..	..	..	7⅜	..	8⅛	8⅛	5¾	4¾	161/0	161/0	82/0	82/0	84/0	34/10/0	32/10/0	41/0/0	34/10/0	32/10/0	41/0/0	..	..	..	..
Nov. 7	..	..	..	..	..	..	7¼	..	8	..	5⅝	4¾	162/0	161/0	83/0	83/0	84/0	35/0/0	33/0/0	42/0/0	34/10/0	32/10/0	..	..	..	..	..
„ 13	..	..	..	..	..	..	7⅛	..	7⅞	7⅞	5½	4¾	172/0	..	..	..	87/0	36/0/0	34/0/0	41/10/0	35/10/0	33/10/0	41/0/0	..	..	..	..
„ 19	..	..	..	..	..	..	7	..	7⅝	7⅝	5½	4¾	178/0	162/0	..	..	88/0	36/0/0	34/0/0	41/10/0	35/10/0	33/10/0	41/0/0	..	..	..	..
„ 27	..	..	..	..	..	..	7	..	7½	7⅝	5½	4¾	180/0	164/0	..	..	91/0	35/10/0	33/10/0	42/0/0	35/0/0	33/0/0	41/10/0	..	..	..	..
Dec. 4	..	..	..	..	..	..	7	..	7½	7⅝	..	..	181/0	169/0	90/0	89/0	91/0	36/0/0	34/10/0	44/10/0	35/10/0	33/10/0	44/0/0	..	..	..	..
„ 11	..	..	..	..	..	..	7	..	7½	7⅝	5½	4¾	168/0	168/0	90/0	91/0	92/0	36/10/0	35/0/0	44/10/0	36/0/0	34/0/0	44/0/0	..	..	..	..
„ 18	..	..	..	..	..	..	..	..	7½	7⅝	6½	5½	172/0	158/0	91/0	92/0	92/0	37/10/0	35/10/0	45/0/0	37/0/0	35/0/0	44/10/0	..	..	..	..
„ 24	..	..	..	..	..	..	7⅛	..	7½	7⅝	5⅝	5	164/0	152/0	92/0	91/0	94/0	39/0/0	37/0/0	46/0/0	38/0/0	36/0/0	45/0/0	..	..	..	..
„ 31	..	..	..	..	..	..	7½	..	7½	7½	6	5	153/0	147/0	93/0	92/0	94/0	39/10/0	37/10/0	48/10/0	38/10/0	36/10/0	47/10/0	..	..	..	..
1916. Jan. 8	..	..	..	..	..	..	7½	..	7¾	..	6¼	5½	156/0	153/0	94/0	93/0	97/0	..	..	..	40/10/0	38/10/0	50/0/0	..	..	..	..

NEW ZEALAND - VANCOUVER TRADE.

FOLLOWING are shipments of produce from New Zealand for Vancouver from September, 1915, to January, 1916:—

—	"Niagara," 7th Sept.	"Makura," 5th Oct.	"Niagara," 2nd Nov.	"Makura," 30th Nov.	"Niagara," 28th Dec.
Butter, boxes	647	180	180	..	600
Mutton, carcases	..	..	..	..	..
Lamb, "	..	..	..	..	..
Beef, quarters—pieces	..	..	..	..	..
Veal, carcases	..	..	..	..	..
Frozen sundries, packages	12	..	..	..	..
Wool, bales	541	415	898	437	2,563
Grass-seeds, &c., sacks	..	..	..	1	150
Hides and skins, sacks, &c.	1,793	2,388	1,696	1,322	2,165
Onions, cases	..	..	..	..	..
Sheep-skins, bales	100	103	69	31	492
Jam, cases	..	..	..	..	..
Sundries, packages	92	19	8	4	22
Pelts, casks	73	16	88	..	59
Kauri-gum, packages	1,787	1,608	933	1,168	1,286
Hemp, bales	..	..	..	..	491
Meats (canned, &c.), cases	..	..	..	..	..
Cheese, crates	..	..	..	..	..
Fresh fruit, cases	..	..	..	..	..

NEW ZEALAND - SAN FRANCISCO TRADE.

FOLLOWING are shipments of produce from New Zealand for San Francisco (including transhipments for Vancouver) from September, 1915, to January, 1916:—

—	"Marama," 16th Sept.	"Maitai," 14th Oct.	"Moana," 11th Nov.	"Maitai," 13th Dec.	"Moana," 6th Jan.
Wool, bales	..	..	..	914	815
Gum, packages	73	27	15	12	32
Milk, cases	..	..	..	..	1,000
Grain, &c., sacks	9	26	80	30	..
Meat, cases	71	..	..	..	..
Onions, cases	3	1	..	..	..
Potatoes, sacks	10	..	..	..	..
Sundries, packages	1,045	195	167	95	167
Butter, boxes	5	..	..	..	..
Hemp, bales	1,262	1,123	668	1,034	1,432
Frozen lamb, carcases	3	..	..	..	..
Hides and sheep-skins, sacks and bales	..	..	..	119	150
Beef, quarters—pieces	..	..	..	..	..
Cheese, crates	1	..	..	..	..
Peas, sacks	2,374	1,125	100	94	187

STOCK EXPORTED.

THE following table shows the numbers and descriptions of stock exported from the Dominion during the month of December, 1915:—

Port of Shipment.	Horses.			Sheep.			Cattle.			Pigs.		Dogs.	
	To Australia.	To Eastern Pacific.	To Japan.	To Australia.	To Eastern Pacific.	To Montevideo.	To Australia.	To Eastern Pacific.	To Norfolk Island.	To Australia.	To Eastern Pacific.	To Australia.	To Eastern Pacific.
Auckland ..	..	29	..	..	175	..	..	6	..	..	22	..	..
Gisborne ..	..	..	..	..	..	..	..	..	..	..	..	..	..
Napier ..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wellington..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lyttelton ..	1	..	..	10	..	..	..	..	..	..	..	..	..
Dunedin ..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bluff ..	..	..	..	..	..	..	..	..	..	..	..	..	..
Totals ..	1	29	..	10	175	..	..	6	..	..	22	..	..

The following are particulars of the horses shipped: 1 thoroughbred horse, 6 medium draught geldings, 1 harness gelding, 22 cavalry remounts.

Auckland also exported 9 crates poultry.

STOCK IN QUARANTINE.

THE following table shows the number and descriptions of stock exported from the Dominion during the month of December, 1915:—

No.	Description.	Sex.	Port of Origin.	Owner or Agent.	Address.
			MOTUIHI ISLAND (AUCKLAND).		
1	Aberdeen Polled Angus bull	Male ..	London ..	Douglas Estate ..	Mount Royal, Palmerston.
2	Aberdeen Polled Angus heifers	Female	,, ..	,, ..	Ditto.
			SOMES ISLAND (WELLINGTON).		
2	Red Dane bulls	Male ..	Melbourne	Quinton Donald ..	Featherston.
2	Border Leicester sheep	,, ..	London ..	Department of Agriculture	Wellington
4	Ditto ..	Female	,, ..	Ditto	Ditto
1	Southdown ram	Male ..	,, ..	James Knight ..	Palmerston N.
1	Collie dog ..	,, ..	,, ..	C. S. Hay ..	Wanganui.
1	,, ..	Female	,, ..	,, ..	,,
3	Shropshire sheep	Male ..	,, ..	Mr. Vavasour ..	Blenheim.
6	,,	Female	,, ..	,, ..	,,
3	Romney rams..	Male ..	,, ..	Mr. Elgar, c/o N.Z. Loan and Mercantile Agency Co.	Wellington.
			QUAIL ISLAND (LYTTELTON).		
2	Border Leicester rams	Male ..	London ..	Douglas Estate ..	Mount Royal, Palmerston.
3	B. Leicester ewes	Female	,, ..	,, ..	Ditto.
2	B. Leicester rams	Male ..	,, ..	James Ross ..	Palmerston.
1	Irish terrier ..	,, ..	,, ..	Mrs. Wilding ..	Opawa.

HEMP AND TOW GRADING RETURNS.

DECEMBER.

Hemp.—The total number of bales graded was 14,129, as compared with 6,645 for the corresponding month of last year, an increase of 7,484 bales. For the twelve months ending 31st December, 1915, the number of bales graded was 120,822, as compared with 98,244 for the previous twelve months, an increase of 22,578 bales.

Tow.—During the month 4,440 bales were dealt with, as compared with 1,814 for the corresponding month of last year, an increase of 2,626 bales. For the twelve months ending 31st December, 1915, the number of bales graded was 32,970, as compared with 29,993 for the previous twelve months, an increase of 2,977 bales.

Stripper-slips.—The number of bales graded was 756, as compared with 100 for the corresponding month of last year, an increase of 656 bales. For the twelve months ending 31st December, 1915, the number of bales graded was 4,057, as compared with 1,362 for the previous twelve months, an increase of 2,695 bales.

HEMP, TOW, AND STRIPPER-SLIPS GRADED THROUGHOUT THE DOMINION DURING THE MONTH OF DECEMBER, 1915.

Hemp.

Port.	Superior.	Fine.	Good-fair.	Fair.		Common.	Rejected.	Condemned.	Total.
				High Point.	Low Point.				
	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.
Auckland ..	..	..	250	1,051	1,024	147	8	9	2,489
Napier ..	..	..	83	..	..	..	..	..	83
Wairoa ..	..	..	..	..	..	..	..	..	..
Foxton ..	..	..	1,090	2,142	1,300	120	47	42	4,741
Wellington ..	..	..	573	2,314	1,754	373	35	31	5,080
Picton ..	..	..	40	..	..	..	..	..	40
Blenheim ..	..	..	148	88	..	..	..	..	236
Lyttelton ..	..	..	..	..	..	..	..	..	..
Dunedin ..	..	..	203	73	..	..	..	..	276
Bluff ..	..	..	331	755	98	..	..	..	1,184
Totals ..	..	..	2,718	6,423	4,176	640	90	82	14,129
Percentages of totals	..	..	19·24	45·46	29·55	4·53	0·64	0·58	..

Tow.

Port.	First Grade.	Second Grade.	Third Grade.	Condemned.	Total.
	Bales.	Bales.	Bales.	Bales.	Bales.
Auckland ..	..	245	653	101	999
Napier ..	..	..	13	..	13
Foxton ..	358	702	175	15	1,250
Wellington ..	192	734	321	34	1,281
Picton ..	..	22	..	..	22
Blenheim ..	35	123	..	..	158
Lyttelton ..	..	..	..	..	..
Dunedin ..	..	115	..	..	115
Bluff ..	..	272	320	10	602
Totals ..	585	2,213	1,482	160	4,440

Stripper-slips.—Auckland: Second grade, 14; condemned, 27—total, 41. Foxton: First grade, 34; second grade, 358—total, 392. Wellington: First grade, 24; second grade, 245; condemned, 24—total, 293. Blenheim: Second grade, 5. *Bluff: Second grade, 25.*

The

Journal of Agriculture.

WELLINGTON, NEW ZEALAND.

21ST FEBRUARY, 1916.

CERTIFICATE - OF - RECORD TESTING IN 1915.

SOME COMMENT ON THE YEAR'S WORK.

W. M. SINGLETON, Assistant Director, Dairy Division.

THIS third year's experience of the system of testing purebred dairy cattle in New Zealand has enabled breeders and others interested to obtain a wider vision of the work, to concentrate their ideas regarding it, and to accept at its net worth this new phase of gleaning knowledge for the strengthening of their vocations as improvers of dairy cattle. The true breeder is a student whose inherent ability and close application make him more than an owner who merely mates purebred cattle. The certificates of record assist the true breeder to so plan his year's programme that "utility" will get its rightful place thereon.

From the viewpoint of the economic influence of this work it is considered that paramount importance should be attached to the help which breeders receive through the records assisting their judgment in selecting the best strains to procreate. That

the average dairyman requires such assistance as the certificates of record disclose is fully recognized. However, unless the fountain-head, which the purebred herd represents, be kept pure and at its best the dairyman cannot expect the utmost satisfaction. It is essential, therefore, that the most suitable individuals from such viewpoints as utility, constitution, and conformation should be retained for stud purposes, and that their influence should not be restricted to grade or crossbred herds. Prior to the certificate-of-record testing, many breeders were not in possession of as much information regarding the strains represented in their herds as is the case to-day. In this connection many females have been disposed of which would now be retained, and which would doubtless in many instances have been used to better advantage in the parent herd.

The influence of this certificate-of-record testing on the average dairyman is patent, although the result may not be so encouraging as was expected. The general tendency amongst dairy-farmers at present to "husband their resources" is perhaps responsible for less demand for purebred dairy bulls than was expected last spring. When it is recognized that sound economy consists more in making good investments than in hoarding cash, it seems that many a dairy-farmer is making an error in postponing the purchase of a purebred bull of proved butter-fat-producing strain as a head for his herd. As far as the writer can see, dairy-farmers have no reason to fear the future. The special-purpose dairy cow has come to stay, for the simple reason that she can produce food for human consumption cheaper than can any other animal.

In some comment on "Our Dairy Breeds on Yearly Test," in the *Journal* for December, 1914, the writer stated that "the future should bring some demand from overseas, for even now we have stud stock which would benefit other countries." During 1915 a Friesian bull was exported by Mr. J. Donald, Westmere, to New South Wales. We know also of some other shipments. Inquiries from abroad have lately been received which may yet result in business for our breeders. That class of advertising which certificates of record make possible has a special interest to intending purchasers, and it is doubtless not overstating the case in the slightest to say that any such overseas business has been stimulated and brought about by the New Zealand records of production. Of these records we have every reason to be proud, and we hope our own dairymen will see that not too many bulls go abroad, also that all other good ones are used to the best advantage in our Dominion.

CERTIFICATES ISSUED.

The total number of cows admitted to the certificate-of-record classes during the past calendar year evidences a slight decrease over that of the preceding twelve months. In 1914, 188 cows received certificates, while in 1915 this number was reduced to 168. In 1914 there were twenty-five repeat certificates, as against thirteen in 1915. The table below indicates that each of the three breeds in test last season is a few cows short.

The falling-off is so small that the scarcity of labour caused by the war accounts for these, and probably for a number of others that would represent a potential increase. A number of breeders who supported this work enthusiastically during 1914 found it inconvenient to undertake the work during the past year. Several of these are endeavouring to arrange to again take up the testing of their cows during next season.

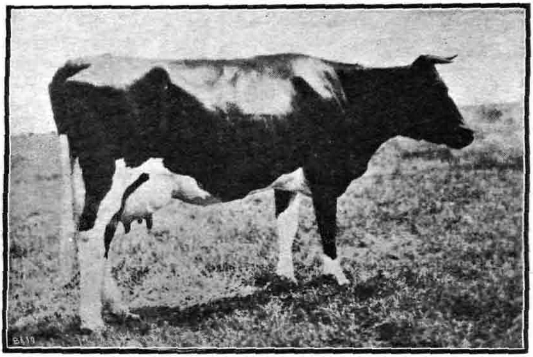
During the three years of this work certificates have been issued on the production of 471 dairy cows, and have been distributed as follows: Jerseys, 262; Friesians, 177; Ayrshires, 30; Milking Shorthorns, 2. In tabular form the figures are,—

——	1913.	1914.		1915.	
		Ordinary.	Repeat.	Ordinary.	Repeat.
Jerseys	67	104	14	91	3
Friesians ..	48	67	11	62	9
Ayrshires ..	..	17	..	13	1
Shorthorns ..	..	..	..	2	..
Totals ..	115	188	25	168	13

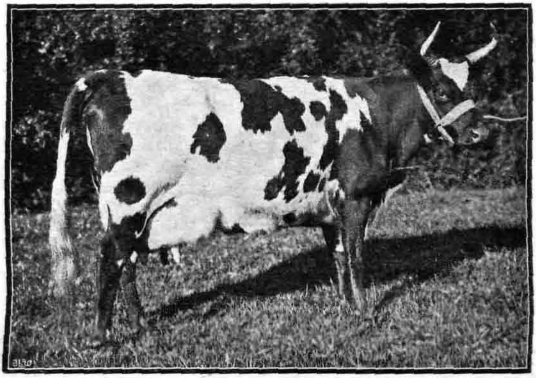
CLASS LEADERS.

Friesians.

The lists of class leaders have been altered considerably during the past season. In the Friesian list, containing the seven classes, there are three displacements. The junior two-year-old class claims a new leader in Mr. Lovelock's Lady of Cliffside II. In the senior three-year-old class Manor Beets Daughter II of Ashlynn has displaced Dutch Girl, owned by Mr. G. Aitchison, of Kaitangata; and Grace Fayne of Ashlynn has won the position of leader of the senior four-year-old class. The record of Manor Beets Daughter II of Ashlynn not only constitutes a record for her class, but gives the cow the premier record for her breed and for New Zealand. Both of these new class leaders are owned by Mr. C. A. Hopping, Rangitikei Line, Palmerston North.



MANOR BEETS DAUGHTER II OF ASHLYNN.
Highest-record Friesian and champion butter-fat cow of New Zealand.



ALEXANDRA OF WAIPAPA.
Highest-record Ayrshire.

The Friesian figures are as follows :—

Name of Cow.	Name and Address of Owner.	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	1914.	Yrs. dys.	lb.		lb.	lb.
Two-year-old Class. Netherland Princess IV	J. Donald, Westmere	2 341	274·6	365	19621·60	805·77
Three-year-old Class. Dutch Girl ..	G. Aitchison, Kaitangata	3 349	311·9	363	18332·25	644·54
Four-year-old Class. Annette V of Brundee	W. H. Bayliss, Mangatainoka	4 112	324·7	330	14401·00	545·30
Mature Class. Holland Queen ..	A. J. Gallichan, Tiakitahuna	5 52	350·0	365	20629·90	755·78
	1915.					
Junior Two-year-old Class. Lady of Cliffside II ..	W. I. Lovelock, Palmerston North	2 117	252·2	365	16320·50	535·22
Senior Two-year-old Class. Netherland Princess IV	J. Donald, Westmere	2 341	274·6	365	19621·60	805·77
Junior Three-year-old Class. Gladys II	G. Aitchison, Kaitangata	3 155	292·5	304	15788·25	614·00
Senior Three-year-old Class. Manor Beets II of Ashlynn	C. A. Hopping, Palmerston North	3 296	306·6	365	18733·90	863·51
Junior Four-year-old Class. Annette V of Brundee	W. H. Bayliss, Mangatainoka	4 112	324·7	330	14401·00	545·30
Senior Four-year-old Class. Grace Fayne of Ashlynn	C. A. Hopping, Palmerston North	4 302	343·7	351	17934·00	716·05
Mature Class. Holland Queen ..	A. J. Gallichan, Tiakitahuna	5 52	350·0	365	20629·90	755·78

Jerseys.

Three of the Jersey classes changed leaders during the year. Hill Crest Hope, owned by Mr. E. S. Lancaster, Levin, has displaced Mr. A. A. Ward's Miro as leader of the two-year-old class. A record of 616·5 lb. butter-fat for this young cow, commencing her lactation period at the age of 2 years 7 months, reflects great credit on the cow and owner, and does credit to the Dominion as well.

In the three-year-old class a new leader appears in Belvedere Sungleam, the property of Mr. E. B. Eagle, of Belvedere, Carterton. As the class leader at the end of the year this cow dis-displaces Pepper, owned by the late Captain A. E. Wilkinson, of Pukekohe. Belvedere Sungleam's record raises the class maximum some 80 lb. of butter-fat, which is a most gratifying increase. In the four-year-old class Lady of Collingwood has displaced Mr. F. S. McRae's Charm. This new leader's record was commented upon in last month's *Journal*. Madam Mayflower retains her position as leader of the mature class, and is the only Jersey class leader of 1914 to do so.

The Jersey figures for 1914 are compared with those for 1915 in the following tables :—

Name of Cow.	Name and Address of Owner.	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	1914.	Yrs. dys.	lb.		lb.	lb.
Two-year-old Class.						
Miro	A. A. Ward, Miro ..	2 357	276·2	365	8835·70	548·69
Three-year-old Class.						
Pepper	A. E. Wilkinson, Pukekohe	3 195	296·5	365	9288·40	546·01
Four-year-old Class.						
Charm	F. S. McRae, Palmerston North	4 347	348·2	365	9980·10	572·52
Mature Class.						
Madam Mayflower ..	H. B. Curtis, Inglewood	5 307	350·0	365	11793·20	763·41
	1915.					
Two-year-old Class.						
Hill Crest Hope ..	E. S. Lancaster, Levin	2 214	261·9	365	10733·90	616·50
Three-year-old Class.						
Belvedere Sungleam	E. B. Eagle, Carterton	3 329	309·9	365	11044·80	626·46
Four-year-old Class.						
Lady of Collingwood	F. E. Hellyer, Dunedin	4 86	322·1	365	12096·50	736·07
Mature Class.						
Madam Mayflower ..	H. B. Curtis, Inglewood	5 307	350·0	365	11793·20	763·41

Ayrshires.

Amongst the Ayrshire classes more changes have occurred in cows holding the premier position. In the two-year-old class Messrs. Weir Bros.' Bluebell of Glenweir has displaced her half-sister and herdmate, Miss Russell. Kanadale Fanny, owned by Messrs. Cockburn Bros., of Mataura, had the honour of continuing as three-year-old class leader throughout the entire calendar year. In the four-year-old class a worthy leader has been found in Mr. F. Mills's Alexandra of Waipapa. This young cow has raised the class maximum by 184 lb. butter-fat.

In the mature class a new leader is indicated in Minnie of Glenweir. As class leader her record exceeds by some 36 lb. butter-fat that of the former champion, Fancy IV of Cambridge, owned by Messrs. Watt Bros. After completing this record at the beginning of the calendar year 1915, Minnie was continued in test, and again freshened in less than twelve months of her previous calving. In this last lactation period she produced 476·29 lb. fat from 10,543 lb. milk in 326 days.

The Ayshire figures are as follows:—

Name of Cow.	Name and Address of Owner.	Age at starting Test.		Fat req'd. for Cert.	Yield for Season.		
					Days.	Milk.	Fat.
	1914.	Yrs.	dys.	lb.		lb.	lb.
Two-year-old Class.							
Miss Russell ..	Weir Bros., Pukehiki ..	2	256	266·1	340	8252·60	365·84
Three-year-old Class.							
Kanadale Fanny ..	Cockburn Bros., Mataura	3	294	306·4	314	8918·80	361·49
Four-year-old Class.							
Posy of Cambridge ..	J. and C. Watt, Cambridge	4	31	316·6	320	9869·10	406·91
Mature Class.							
Fancy IV of Cambridge	Ditto	8	14	350·0	365	11686·50	492·03
	1915.						
Two-year-old Class.							
Bluebell of Glenweir	Weir Bros., Pukehiki ..	2	355	276·0	365	8214·40	371·02
Three-year-old Class.							
Kanadale Fanny ..	Cockburn Bros., Mataura	3	294	306·4	314	8918·80	361·49
Four-year-old Class.							
Alexandra of Waipapa	F. Mills, Hawera ..	4	348	348·3	365	14348·60	591·16
Mature Class.							
Minnie of Glenweir ..	Weir Bros., Pukehiki ..	6	11	350·0	363	11471·10	528·92

Shorthorns.

During the year two cows entered in the Milking Shorthorn Herd-book, at Palmerston North, received certificates. Both these cows were owned by Mr. E. Law, of Shannon, and were in the mature class. Particulars of their records are given in table on page 98.

LENGTH OF TESTING PERIOD.

Special attention may be directed to the reduction in "repeat" certificates. It has been suggested that the twelve-months' milking-period and the ninety days' grace before the limit when subsequent calving must take place to qualify for a certificate create conditions so abnormal that three calves only are dropped in four years. It has also been stated that the length of the testing

season should correspond with dairy-farm conditions—viz., nine to ten months. Actual results of this work indicate—(1.) That less than eight cows in every hundred tested are on repeat tests. Usually one certificate of record suffices. The suggestion of three calves in four years is merely theoretical: it does not obtain in practice, since retesting is the exception rather than the rule. (2.) That instead of throwing cows "out of their season" for an indefinite number of years, every cow tested could be served in sufficient time to ensure the second calving after testing season to fall within the periods of usual dairy-farm practice. In such cases only one season, if any, need be shorter than the average.

MADAM MAYFLOWER.
Highest-record Jersey.

(3.) That a twelve-months milking-period gives the persistent milking-strain an opportunity of demonstration. A purebred bull from a dam that can scarcely be dried off in twelve months is a better proposition to a farmer with a grade herd than is a bull from a dam equal to only nine months' production. Most grade herds can afford to have their milking-period extended, and with profit to their owners.

YIELDS OF VARIOUS CLASSES.

It is satisfactory to note that the average production of each and every class evidences an increase over the preceding year.

Breeders have shown a disposition to meet the demand for butter-fat purebred bulls, and have with commendable enterprise brought before the dairy-farming community evidence that in New Zealand there are sires which will head a dairy herd with every prospect of increasing the yield of the progeny.

Friesians.

The yield of the Friesian classes is as follows :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1914.		lb.	lb.
Two-year-old	25	344	11,213·12	400·90
Three-year-old	21	332	13,244·80	457·55
Four-year-old	8	325	13,077·37	441·25
Mature	24	322	13,404·21	482·14
	1915.			
Junior two-year-old ..	18	350	11,010·39	395·07
Senior two-year-old ..	9	345	11,893·7	423·37
All two-year-old	27	348	11,304·84	404·51
Junior three-year-old ..	7	345	11,894·20	395·00
Senior three-year-old ..	16	341	13,303·11	510·19
All three-year-old	23	343	12,874·31	475·14
Junior four-year-old ..	2	325	12,816·65	425·30
Senior four-year-old ..	4	361	14,251·30	49[illegible]·20
All four-year-old	6	349	13,773·08	472·57
Mature	15	346	13,507·93	490·93

The mature classes show a smaller number of animals getting certificates during 1915 than during the preceding year. This is doubtless due to a desire to test heifers during their first or second lactation period. It would not be surprising if, as this work continues, the percentage of certificates becomes yet more in favour of the younger classes.

Jerseys.

The Jersey yields are as follows :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1914.		lb.	lb.
Two-year-old	36	333	6,090·34	335·46
Three-year-old	22	332	7,616·71	412·09
Four-year-old	12	323	7,064·08	393·71
Mature	48	338	8,737·31	471·15
	1915.			
Two-year-old	39	343	6,581·93	370·81
Three-year-old	21	354	7,767·46	448·45
Four-year-old	14	335	8,571·80	470·13
Mature	20	349	8,837·19	490·79

Ayrshires.

The various classes of Ayrshires are also credited with increased yields during the past twelve months. The production of many of these certificate-of-record Ayrshires is very creditable. In a number of instances the animals got a comparatively short milking-period, and this point should receive due consideration. It is hoped that fanciers of the Scotch breed will bring under test a larger proportion of their good animals. Although a few breeders have done their breed and their herds every credit, wider support is necessary if the breed is to receive its due.

The Ayrshire figures are as follows:—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1914.		lb.	lb.
Two-year-old	7	304	7,822·17	312·70
Three-year-old	4	322	8,595·30	341·44
Four-year-old	2	332	9,5[illegible]8·80	380·60
Mature	4	353	10,710·47	443·87
	1915.			
Two-year-old	3	335	7,5[illegible]·4	324·87
Three-year-old	1	302	10,95[illegible]·1	360·34
Four-year-old	3	349	11,199·1	437·02
Mature	7	344	10,894·6	462·19

Shorthorns.

Milking Shorthorns registered in the Palmerston North Herd-book received two certificates. This is the first year during which the breed has had representatives qualify for certificates, so that no comparative returns can be given.

The results for the year are as follows:—

	Age.		Fat req'd for Cert.	Days in Milk.	Milk.	Fat.
	Yrs.	dys.	lb.		lb.	lb.
Maisie	6	334	350	364	10,021·0	431·30
Pansy I ..	5	335	350	304	9,478·5	354·52

PREPOTENT DAIRY SIRES.

The records of yields of purebred dairy cows suggest to breeders and others interested the utility of such as an indication of the prepotency of the sires of such certificate-of-record cows. Since the inception of this testing movement we have kept a special list of bulls that have at least four C.O.R. daughters from different dams. A knowledge of the number of tested daughters of a bull creates a special interest in any pedigree including his name. Below are given the names of such qualified bulls and the number of their respective daughters that have qualified during last year, also (in brackets) the total number of their C.O.R. daughters.

Jerseys.

K.C.B., 5 (11); Majesty's Fox, 6 (10); Eminent's Fontaine, 5 (9); Starbright, 6 (8); M.L.C., 4 (8); Blizzard, 1 (7); Stevenson, 2 (6); Goddington, 2 (5); Lord Lepperton, 1 (5); Golden Swan, 3 (4); Frisky Campanile, 3 (4); Glory, 1 (4); M.H.R., 1 (4); Good Luck, 1 (4); Campanile's Sultan, 0 (5); Pride of Egmont, 0 (5).

Friesians.

Sir de Kol Inka Pietertje, 3 (12); Paul Pietertje, 6 (9); Grace's Netherland of Riverside, 5 (9); Nazli de Kol, 1 (9); Cliffside Laddie, 5 (7); Kruger II, 2 (6); King Segis Wild Rose Homestead, 4 (5); Colonel Manor of Riverside, 2 (5); Longbeach Van Tromp, 1 (5); Colantha Johanna Lad, 2 (4); Edinglassie, 0 (5); Netherland King, 0 (4).

Ayrshires.

The only Ayrshire bull that has yet proved himself on the above standard as a producer of C.O.R. daughters is King Cole. Reference was made in the *Journal* of last June to this bull and his progeny. Messrs. Weir Bros. have received certificates on the yield of five daughters which they have tested.

APPRECIATION.

A considerable amount of correspondence has, as usual, been necessary between this office and the secretaries of the Jersey Cattle Breeders' Association, the Holstein-Friesian Association, the Ayrshire Cattle Breeders' Association, and the Milking Shorthorn Association, all of Palmerston North. All of these have done what they could to facilitate the work, and their co-operation is much appreciated. Preceding figures will indicate that most of the correspondence has devolved on the secretaries of the two first-named associations. We recognize that this certificate-of-record testing has increased the duties of Messrs. Tapp and McKenzie considerably. The enthusiasm of each of these officers for his association and his favourite breed is inspiring.

Delay in issue of Journal.—The late issue of the *Journal* this month is due to the concentration of the main strength of the Government Printing Office on the printing of the rolls connected with the new recruiting system. During the carrying-out of this very big undertaking in a limited time other printing work had of necessity to be deferred. Subscribers and others will, we feel sure, accept the situation with good will, recognizing the urgency of the important national war measure causing the delay.

THE STONY LANDS OF CANTERBURY.

A NEW SYSTEM OF TREATMENT.

E. B. MILLTON.

ALONG the foothills of Canterbury, particularly where the snow-fed rivers leave the gorges of the mountains, are considerable areas of land so bestrewn with boulders that their cultivation is a work of great difficulty and expense. Happily, however, in conjunction with these boulders there is a considerable depth of

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BOULDERS AND TURNIPS.
The turnip crop is half fed-off.

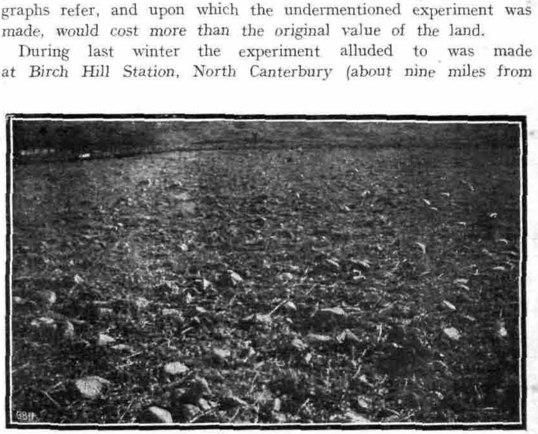
black soil which admits of deep ploughing, and in response thereto and to a copious rainfall turnips, rape, kale, and grass grow abundantly.

The implements chiefly used for the production of these crops are the swamp plough and giant tripod harrows—the former a single-furrow of sufficient strength to withstand the impact with earth-bound boulders even when it is drawn by six stout horses; the latter a flexible harrow of such weight and substance as to require a similar team. It is unnecessary to explain that every

process of cultivation which is undertaken in respect to land of the above nature is fraught with most discouraging difficulties to the husbandman and with extraordinary stress to his implements.

Attempts are made to gather and remove the boulders, but of late years, owing to the cost of labour, the expense has not been warranted. Indeed, to hand-gather and cart off the stones above 5 in. in diameter from the land to which the accompanying photographs refer, and upon which the undermentioned experiment was made, would cost more than the original value of the land.

During last winter the experiment alluded to was made at Birch Hill Station, North Canterbury (about nine miles from



COCKSFOOT FIELD. SHOWING BOULDER-STREWN SURFACE.

It was impracticable to use a mower or reaper and-binder when the field was in this condition.

Rangiora), with a view of cheapening and expediting the process of stone-gathering. In the field trials which were undertaken the Ashley County Council warmly co-operated by affording the use of an Austin road-grader. As the result of a fairly exhaustive trial upon land which was in no manner prepared for the test, the writer offers to those in possession of very stony land some suggestions for their consideration, trusting that his attempt to solve a difficult problem may induce others to experiment in the same direction and lead to an interchange of ideas which may benefit a very large area of land within the Canterbury Province and possibly elsewhere.

The photographs will give an indication of the nature of the country subjected to the test. The result of the trial so far satisfies the writer that he purposes working stony land upon the system described below.

THE SYSTEM DESCRIBED.

The fields will be ploughed in lands which cross the natural fall in the country. These lands will also ordinarily cross the sweep of the north-westers in Canterbury. The width of the lands will be approximately 25 yards, but the exact width will be determined by the breadth of the farmer's drill and broadcaster.

THE SAME COCKSFOOT FIELD AFTER THE BOULDERS HAD BEEN SWEPT INTO ROWS BY THE GRADER.

Many of the stones are 10 in. in diameter.

The proposal is to plough these lands twice, or three times if necessary, to the same centre-line—not necessarily in the same season, but in the ordinary course of cultivation—so as to form a deep furrow at the finishes. The headlands are to be gathered inwards each time the field is ploughed, so as to produce a similar deep and broad furrow at the margins.

The lands will then be worked with a heavy clay-grubber, or other suitable implement, to bring as many boulders as possible to the surface. Finally the land will be sown down—preferably in turnips.

After feeding off, the sheep will have produced a hard-padded, fairly level surface, which appears to the writer to be the condition best suited to the subsequent operation of grading. The latter consists of sweeping the boulders into the parallel furrows and, finally, of clearing the headlands into the furrows adjacent to the fence-lines.

The cost of removing the stones as proposed would approximate that of breaking up the land in the first instance with a swamp-plough and six horses, plus the wages of an extra man on the grader.

HEADLAND OF THE SAME FIELD.

The boulder rows have had their ends dressed by the grader, and loose stones on headland have been swept off to the fence-line on right.

POINTS OF THE SYSTEM.

To sum up, the following advantages and disadvantages of the proposed system occur to the writer :—

Advantages.—The land which at present can be used for green crops only will become available for grain, hay, and grass-seed.

The land, cleared of boulders, can be ploughed with double-furrows, and wear-and-tear will be greatly reduced for all classes of implements. The use of a roller will no longer be impracticable.

The loss of fertilizers and seed owing to drill-coulters lifting on boulders, and to harrows failing to cover the seed properly, will be minimized.

Turnip crops in the early stage can be harrowed with light tine-harrows, a process which is impracticable on very stony land.

The eradication of weeds, twitch, &c., will no longer be impossible.

Disadvantages.—The land cannot be cross-ploughed or cross-worked. In view, however, of the excellent implements available and the free nature of stony land the foregoing is a minor consideration.

The rows of boulders in the aggregate will cover a considerable breadth of land. Against this must be placed the fact that if the system suggested be carried out the boulders will cover subsoil only. In any case the boulders, if left strewn about the surface, cover in the aggregate a greater area. Further, if the owner of the land considers the carting-off of the boulders worth the expense the process will be greatly facilitated and cheapened by grading into rows in the first instance.

JOHN GREENWOOD CLAYTON, M.R.C.V.S.

AN APPRECIATION.

C. J. REAKES, D.V.Sc., M.R.C.V.S., Director, Live-stock Division.

AFTER a long and most plucky fight against a deadly malady, Mr. J. G. Clayton, Senior Veterinarian in the Department, died on the 23rd January. He may almost be said to have died in harness, for he was at work on the 21st.

In addition to his position in the Department of Agriculture, Mr. Clayton had important responsibilities in connection with the Defence Department, being Principal Veterinary Officer for the Canterbury District, with the rank of Lieutenant-Colonel. He came to New Zealand in 1899, having been engaged in London by the New Zealand Government for service with the Department of Agriculture. During his official career he throughout did good work, and especially proved himself to be one of the very best veterinary surgeons in the Dominion. His knowledge was sound, his practice correct, and I am sure that it is expressing the general opinion of all his fellow professional men here to state that his opinions on professional questions were always accepted as carrying very great weight. Speaking personally, he had for years been one of my most valued colleagues, and I have full appreciation of the loyal and single-hearted work he has done.

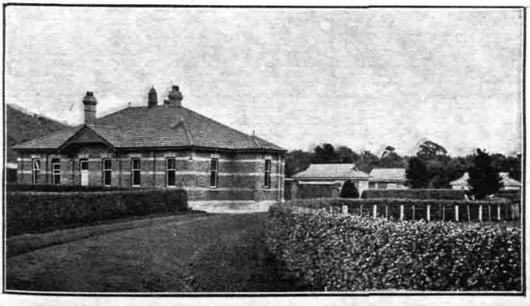
Apart from purely professional knowledge Mr. Clayton had a thorough knowledge of all matters pertaining to the management and care of live-stock. Readers of the *Journal* have at times

expressed appreciation of the replies given to the queries connected with live-stock, both as regards management in health and treatment in disease. Practically since the first issue all these were written by him, except of late, during the periods when a succession of serious operations rendered him temporarily unfit for work of any kind.

Since war broke out extra Defence Department duties claimed a considerable portion of Mr. Clayton's time, these being especially in the direction of supervising—from a veterinary point of view—the fitting-out of horse transports. The good work he did in this branch is amply proved by the excellent results of the many shipments of horses from New Zealand, the average mortality on all voyages up to date being only 3·6 per cent.—this on voyages ranging from thirty to forty-two days in duration through tropical latitudes. In this matter the experience he gained during the South African War proved valuable, he having during that war done service as a horse - transport officer as well as active duty in the field.

Personally, Mr. Clayton was a man of kindly and most generous disposition, and while I believe he had no enemies he certainly had hosts of friends. In his younger days he was a fine athlete, excelling in horsemanship and boxing, and right up to the last he was a real sportsman in the highest acceptation of the term.

By Mr. Clayton's death the Government has lost a good, loyal, and single-hearted officer, and the veterinary profession one of its best-informed and most capable members.



WALLACEVILLE VETERINARY LABORATORY.

TILLAGE OF A COMMERCIAL ORCHARD.

T. E. RODDA, Orchard Instructor, South Canterbury.

FOR the production of abundant and good fruit, and in order to prolong the fruitful period of the trees, it is essential that the soil should be well cultivated. It is therefore very disheartening to see the number of orchards throughout the country that are left entirely untilled. Many of the owners—some of them commercial growers—when asked the question, "Why don't you cultivate?" will probably answer, "For fruitgrowing I consider it a waste of time," or "It does not pay to cultivate for the amount of fruit that the trees produce." Only too true! Such answers inadvertently define the meridian between success and failure. Those growers who have made an intelligent study of soil-tillage in their orchards would never dream of reverting to the once-popular method of sowing to permanent grass, and leaving the trees to fight for their existence and produce what fruit they may.

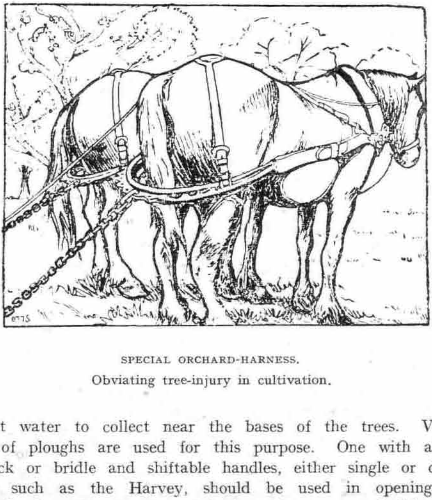
To my mind the advantages of tillage are well described by R. Warington, F.R.S., in his book "Chemistry of the Farm." He says, "The operations of tillage serve in many important ways to make the conditions of plant-life more favourable, and to increase the amount of plant-food which is at the disposal of the crop. By tillage, aided by frost and by alternate drought and rain, the surface soil is pulverized and brought into a loose open condition. The fine tilth thus obtained allows of a rapid extension of the delicate root-fibres, and favours a happy condition of soil-moisture. By the action of the plough the residue of crops, weeds, and manure are buried and incorporated with the soil. The deep tillage of heavy land allows rain to penetrate it, and establishes the drainage of the surface soil and increases its temperature. A shallow surface tillage preserves the mositure of the soil in time of drought. Another important result of tillage is that the soil is thoroughly exposed to the influence of the air. Soils containing humus or clay will under this condition absorb some ammonia from the atmosphere. The oxidation of the nitrogenous organic matter present in the soil will also be greatly facilitated, carbonic and nitric acids being produced. The disintegration and solution of particles of rock will take place from the mechanical and chemical actions brought into play. Of the chemical results brought about

by tillage, the increased production of nitrates must be ranked as the most important."

In this article it is not my desire to write so much for the benefit of the experienced culturist as for the man who does not possess an extensive knowledge of orchard-cultivation.

PLOUGHING AND DISKING.

The soil in the average orchard should be ploughed at least twice a year. At the end of autumn the land should be turned over and left in the furrowed state during the winter. The earth should be banked to the tree, and the land finished in the centre of each row. This ensures good drainage, and does not allow



SPECIAL ORCHARD-HARNESS.
Obviating tree-injury in cultivation.

stagnant water to collect near the bases of the trees. Various makes of ploughs are used for this purpose. One with a long head-rack or bridle and shiftable handles, either single or double furrow, such as the Harvey, should be used in opening out. These ploughs are so constructed that the team and driver are clear of the spreading branches whilst the implement is turning the soil close in to the trunks of the trees. By turning the draught-chain and bridle to the reverse side the plough can be made to turn the earth away from the tree with corresponding ease. Such an implement greatly reduces the danger of barking the trunks

and injuring the branches. The use of Holden and Frost's patent orchard-harness (see sketch) also reduces the amount of branch-injury, and I would advise any grower—be he a large commercial man or the owner of a small area—to procure such gear. It will be money well invested. When the soil is turned to a sufficient distance to ensure branch-clearance, double- or single-furrow ploughs of ordinary make can be used, or the Harvey can be used until the whole orchard is completed.

At the approach of spring, if weather-conditions are favourable, the land should receive a stroke of the disks, and then be ploughed away from the trees. The following year all ploughing should be done across the previous furrows, to ensure all soil being brought under the plough periodically. After completing spring ploughing, the disk harrow should again be brought into use, and a portion of the soil returned towards the tree-trunks by using the implement as a cut-away, in order to obviate the danger of injury to the root-fibres by the drying influences of harsh winds which are often prevalent at that time of the year. If the winds are exceptionally severe it is advisable to waste no time in working the soil back towards the roots. There are numerous makes of orchard disks on the market, including the Barger, the Osborne, and the Harvey. They all work on much the same principle and ensure effective cultivation, whilst the danger of tree-injury is reduced to a minimum if they are operated by a careful driver.

SCARIFYING.

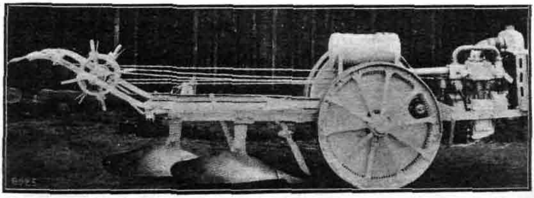
During the growing period, after spring disking, the soil should be stirred at least once a month with a scarifier, to prevent the growth of weeds and to retain that condition of soil-mulch which prevents rapid evaporation of moisture and accelerates the action of nitrifying bacteria. Various makes of scarifiers are obtainable, but perhaps the two most popular makes are the Planet Junior and the Harvey low-down spring-tooth cultivator. The former is a good all-round implement, especially the large thirteen-coulter machine, which stirs the soil for a width of 7 ft. 6 in. at a passage, provided the extensions are used on the outer sides of the wheels. To work this implement effectively in heavy land three good horses will be required, but two can work the machine comfortably if the extension coulters are removed. On the other hand, if the extensions are retained and five of the centre coulters are removed, the implement can be operated easily by two horses, and made to stir the soil close to the trunks without fear of injury to the branches either by chains or swingletrees. When so converted it works on the principle of the orchard disk. To

reduce the danger of root-injury it is advisable to set the two coulters nearest the tree rather lighter than the others. This can be done by slackening off the set-nut of the clamp and lifting the coulter-head in the socket on the back bar of the frame, retightening the nut when the desired adjustment has been obtained. The Harvey spring-tooth cultivator is an ideal implement for close cultivation under spreading trees. It is fitted with a patent attachment whereby the machine can be quickly changed from the ordinary machine which follows the horse to one that will work to the side under the trees while the horse walks clear of the limbs. The machine is set over under the trees by simply dropping a link in the draught-chain and setting the disk, which acts as a rudder at the rear of the machine, at the desired angle.

Both of the above-described implements do really effective work, and are to be recommended for all classes of soils. One thing I would advise amateurs to guard against, and that is never to let weeds get too well established before using the scarifier. One stroke of the cultivator in time—just before the weed-roots have obtained a firm grip of the ground—will be of more value than two or perhaps three strokes of the same implement if the operation is long delayed.

HAULAGE POWER.

The horse supplies the general haulage power in our orchards at the present time, but agricultural motor-tractors are reaching such a high state of efficiency that I venture to predict that we shall see the majority of our leading commercial orchardists using them before many years have passed. Many of the implements in general use at the present time will, with slight alteration, be operated by tractors.



AN UP-TO-DATE MOTOR-PLOUGH.

LUCERNE ON GRAVEL.

B. C. ASTON, F.I.C., Chemist to the Department.

THE photos here shown were taken on the Flaxbourne River, Marlborough, and show the possibilities of river-gravels as a field for growing lucerne. A farmer sowing the adjacent arable lands with lucerne took his team down across the gravel bed of the river to give his horses a drink, neglecting to throw the mechanism controlling the seed-distribution out of gear. The result was that a double width of lucerne was sown on the gravel bed of the river, which, the season being favourable, germinated, and there is now, as is shown, a good stand of lucerne, up to a man's thigh. Another farmer was not slow to profit by this object lesson, and has reclaimed several acres of river-gravel lower down the river.

This is a discovery which might mean many thousands of pounds to the country if proved applicable to other similar areas. In this river there are numbers of white limestone pebbles, but it is probably worth trying elsewhere. In Canterbury alone there are thousands of acres of river-beds which might be brought in in this way, given a good start and a few years suitable for growth. It is doubtful if any flood would then kill out the lucerne.

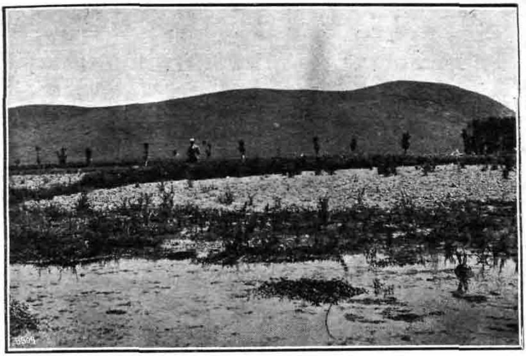
A NEW TYPE OF POA ANNUA.

J. BEVERLEY, Assistant Plant-breeder.

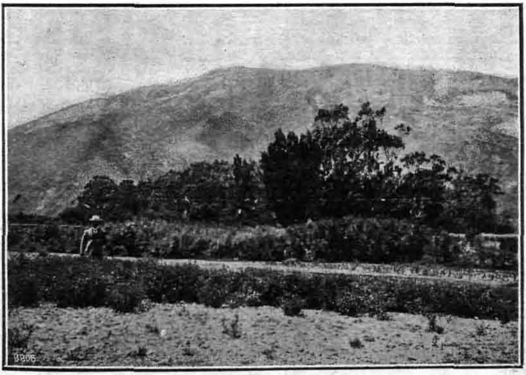
AT this time of the year, when grasses are seeding, it becomes a comparatively easy matter to ascertain the composition of the herbage in our paddocks; but it is more difficult to say what comprises the mixture of a well-kept lawn.

A year ago, in January, 1915, during the long spell of droughty weather experienced, I noticed a patch of green grass on one of the lawns in the Auckland Domain Gardens, where the Exhibition had been held. It was such an "oasis in the desert" that by permission I cut a small sod and brought it to Moumahaki Experimental Farm for analysis and propagation by division. The composition of the sod was as follows: *Agrostis vulgaris*, 70 per cent.; *Poa trivialis*, 20 per cent.; *Poa annua* (new type), 10 per cent.

At the present time these three grasses are being sown separately. The new type of "annual meadow-grass" (*Poa annua*) occupies an area of 3 square yards, forming a dense mat, with no signs of running to seed. It is regarded as being perennialized, and, from its attractive appearance, to have some value.



LUCERNE GROWING IN BED OF FLAXBOURNE RIVER.



ANOTHER VIEW OF THE LUCERNE ON RIVER-GRAVEL.

DYING OF YOUNG FRUIT-TREES.*

R. WATERS, Biological Laboratory Assistant.

PRELIMINARY INVESTIGATIONS.

IN the course of the preliminary investigations by the Department concerning the mortality amongst young fruit-trees a number of the more important orchards in various localities of the Nelson district have now been examined. This district was selected for the work owing to the number of young trees planted there being much greater than in any other fruitgrowing section of the Dominion. Some thousands of young apple-trees throughout this district were found to be affected by fungoid diseases, which come under two heads—

(1.) Those recognized by their fructifications, their fungus fibres (mycelium), and general effects upon the trees :—

Apple-canker (*Nectria ditissima*).

New Zealand root-fungus (*Rosellinia radiciperda*).

(2.) Fungi common on affected trees, but not yet directly correlated with the general effects upon the trees :—

The die-back condition (rare).

The sour-sap condition (symptoms briefly described on page 504 of the December *Journal*).

No fructifications have yet been found on apple-twigs showing the die-back condition. The sour-sap condition, which is by far the commonest affection of young apple-trees throughout the Dominion, is associated (1) with fructifications which produce red or golden fibrils and closely resembling those of apple-bark fungus (*Valsa ambiens*); (2) with fructifications producing black fibrils; (3) with fructifications producing white fibrils; and (4) with a fungus producing pink cushions (stromata) bursting through the bark and leaving crescent-shaped summer spores (conidia) like the coral-spot of the apricot (*Nectria cinnabarina*), and probably belonging to the same species.

Occasionally samples were found of the occurrence alone of each of the fibril-producing fructifications; much more commonly were they found, however, on the same tree as the pink cushions, which

* An introductory article on this subject, by Mr. A. H. Cockayne, Biologist, was published in the *Journal* for December, 1915.

were frequently unaccompanied by any other form of fungus fructification. Until the winter spores have been collected, and the effects of artificial inoculation ascertained, no positive announcement can be made as to which of these four fungus fructifications is capable of producing the condition known to orchardists as sour-sap.

There is much evidence to show that sour-sap is developed almost entirely on trees that have been weakened through unfavourable soil-conditions. An account on the more practical side of this matter will therefore first be given, setting out the observed and the suspected causes of such primary weakness, and the suggested remedial measures which may at once be taken to arrest the progress of this disease.

I. PREDISPOSITION TO SOUR-SAP.

The question has very commonly been asked, "Why have these trees failed: was it through some unfavourable condition of soil, cultivation, weather, &c., or through the attack of a disease?" a question which certainly must be definitely answered before any remedial or protective measures can reasonably be devised. Of this disease (sour-sap) it can be said with confidence that affected trees were weakened primarily by certain conditions which in themselves would not appear to be sufficient to kill the trees, though enough to impair seriously their vigour, fruition, and more especially their power of disease-resistance. Thereafter the attacking fungus found the trees too weak to resist or meet the extra demand on their energy; consequently they were increasingly enfeebled, and often died outright. The reasons why sour-sap has this season been the particular form of fungus which so commonly seized upon debilitated trees cannot be explained fully, but definite evidence is given later on of the means by which fungi have been unwittingly or carelessly maintained in orchards in such a way as to enable or even encourage the formation of spores, the reproductive bodies by which they are commonly perpetuated season by season.

The main causes of debility will now be considered in relation to some of the defective methods employed in the establishment and maintenance of orchards.

1. *Preparation of Land for Planting.* — Several orchards were noted where the trees had been planted soon after ploughing. The floor of the furrow was compact, and the soil above it full of large air-spaces which had not been filled in by the harrows and by the natural settlement which takes place after the lapse of sufficient time; the soil was further kept open by the vegetation turned in but not yet decayed. Thus the ploughed top soil, being considerably disconnected from the damp subsoil by these large

spaces, was unable to restore its moisture-content by capillary action on the water-supply below, and consequently dried out and baked hard.

Such conditions had a decided weakening effect upon young trees striving to establish a root-system, and more disastrously upon those varieties which are at best somewhat delicate onces to grow in certain localities, notably Cox's Orange Pippin. Though this defect in culture is certainly here worthy of note, it would be necessary to secure more evidence to prove conclusively that it was alone sufficient to predispose apple-trees to the attack of sour-sap. It can be said, however, that sour-sap was found amongst trees enfeebled at least from this cause.

That trees in their first years should come on with vigour is well known; for at this time they should form substantial roots and branches which will carry the increasing top, and later the crops, through unfavourable weather. Apart from the establishment of shelter, the first step to induce vigour is that of obtaining good tilth before planting.

2. *Excessive Water in Soil.* — Throughout the localities visited were found numerous instances of undrained, low-lying areas, to which water would gradually flow when rain created an excess in the soil of adjacent higher levels. The unsuitability of such areas for apples was in some instances recognized—pears having been planted—but in many cases apples had been planted, sometimes even to the edge of stagnant or slowly running surface water.

Again, excessive water would at times certainly be found above the iron-pan, considerable evidences of which were seen in several quarters, even on the more elevated land. Iron-pan is formed through the iron in the soil being washed downward and there recombining with other elements to form a more or less hard, impermeable, concrete-like mass, sometimes many inches thick: it was found 1 ft. to 2 ft. 6 in. deep. Certain soils showed signs of abundant iron—rust-coloured drainage water. Others showed the pan itself jutting out in masses where it had been cut through. In one place it was found so thick and strong as to have completely hindered drainage operations for 30 yards until blasting-material could be procured. It was traced in the banks of streams and cuttings adjoining orchard lands. An orchardist stated that the plough glided over pan for many yards at a time on his land; finally it was found turned up by the plough on cultivated land. The effect of pan is to render the soil wetter in rainy weathers and drier in times of drought.

One of the qualifications of a good soil is that it be composed of various-sized particles each of which is surrounded by a film of

water. As the root-hairs of plants draw in water, or as the water is evaporated from the soil surface, these films become thinner at the points thus tapped, and the tension which holds them round the soil-particles becomes greater, with the result that thin films are increased again by their drawing water from adjacent thicker films of weaker tension. In this way much of the movement of water in good soils is effected. Between the particles or particle-aggregations with their surrounding films are minute spaces holding soil-atmosphere, essential to most forms of plant-life. A heavy shower may push out the soil-atmosphere and fill up its pores, but as the water percolates downward or away it draws back atmosphere into the pores, leaving only thick water films round each soil-particle. In low-lying ground towards which surplus water naturally percolates, and from which water may drain but slowly, the air-spaces between particles may be completely filled with water for a considerable time after rain, and more especially if the rain occurs not in one downpour but in a shower every few days for some time.

The absorption of the food-containing water by root-hairs depends upon a sufficiency of soil-warmth and fresh air. Excess of water lowers the soil-temperature and limits the supply of air. The absence or limitation of fresh air, moreover, checks the breathing process of the root-hairs, in which poisonous compounds accumulate as a result. When roots are completely immersed in water root-hairs are generally absent, and would require to be re-formed, as in the case of a transplanted plant, before they could resume their ordinary operations when the soil again became aerated. Upon a good supply of air is also dependent the formation of nitrates by soil-bacteria. Nitrates are essential to plant-life and are, as far as is known, supplied almost exclusively through the agency of soil-bacteria. An insufficiency of nitrates in the soil limits the vegetative vigour of plants.

The weather in the Nelson district towards the beginning of this season was generally recognized by residents as very wet. Statistics show that, though the rainfall for August, September, and October at Motueka was below the average for the past six years, yet the number of rainy days for the same three months was the highest in the last six years—a fact which might account for excessive soil-water even though the rainfall itself was not especially high. However, for the following reasons, it is not here intended to prove that exceedingly wet weather resulted in the outbreak of sour-sap. In the first place, the disease has appeared in many previous seasons not considered exceptionally wet: a very slight increase in soil-water last year might reasonably have been just the required excess to overtax the trees and precipitate a greater out-

break. Secondly, statistics show that while at the advent of last season abundant rain fell, such rainfall was in no way phenomenal. Thirdly, such statistics relate to the rainfall and not to the water-content of soils, which varies according to how the rain falls and according to the nature of the land upon which it descends. Finally, if excessive rain, and that alone, caused the outbreak, then the rain which induced disease on the low ground must have induced it on the high.

FIG. 1. FOUR YOUNG APPLE TREES KILLED BY SOUR-SAP.

The roots have been surrounded with excessive water through the complete blockage of the adjacent tile drain by willow roots. A length of the latter is held up to view after severance and removal from pipes.

That the primary debility amongst the trees was mainly caused by excessive water in the soil there can be no doubt; but such a conclusion cannot be arrived at by a personal or statistical knowledge of the rainfall, though it can be amply proved by a study of the positions in which affected trees stood.

In one orchard sour-sap was noted in over 150 trees distributed over a piece of land sloping gradually down into a bog. At the lower part most of the trees were affected or dead, but as the land rose higher the number of affected trees and the intensity of the attack diminished, till finally no trace of disease could be found. In another orchard of 12,000 young trees only four had been

affected in the entire block. They stood together in a line along the bottom of a depression in the ground. Last year they had grown vigorously, but this year scarcely had their buds burst when they sickened and died. Some 18 in. out from the line in which they stood ran a parallel tile drain, which was found to be com-

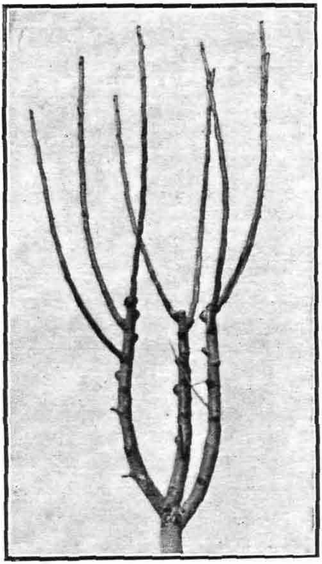


FIG. 2. CLOSER VIEW OF ONE OF THE FOUR TREES SHOWN IN FIG. 1.

Note the vigorous growth of last season's pruned leaders.

pletely blocked by willow-roots. In fig. 1 of the accompanying photographs part of the strip of closely matted roots that blocks the drain is being held up, and the four dead trees are shown as they stood in the line. The other two illustrations are larger-

scale figures of one of the affected trees, No. 3 clearly showing the spore-bearing cushions bursting through the bark.

In every district were found trees situated in badly drained land and injured by sour-sap; in fact, by far the greatest number

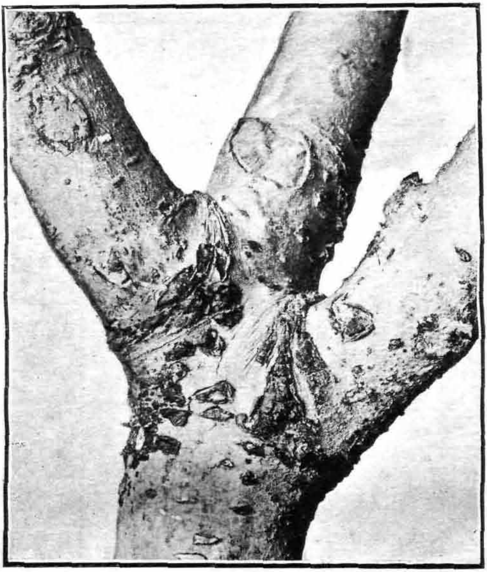


FIG. 3. JUNCTION OF THE PRIMARY BRANCHES WITH THE STEM OF THE TREE SHOWN IN FIG. 2. (NATURAL SIZE.)
Note spore-bearing cushions bursting through the bark.

of affected trees were found on wet land. On the other hand, low-lying land, well drained, showed no trace of disease.

It is therefore concluded that the main cause of the debility preceding sour-sap in young apple-trees is that of planting in those low-lying positions where the accumulation of surface water

unduly limits the soil-aeration essential to healthy growth. The remedy is either to refrain from planting apples in such positions or to amend the soil-conditions by drainage. Where wetness is due to pan it is suggested that the extent and character of this formation be ascertained, and, if it will not yield to milder treatment, blasting-material should be employed. Lime would be of value on soils soured by excessive water.

3. *Feeble Nursery Stock.*—A small percentage of the trees of an orchard are frequently seen to be feeble for no very obvious reason; they are simply smaller and perhaps weaklier than the surrounding trees planted at the same time and subjected to the same conditions. Such debility has in many cases been traced to feeble nursery stock. A greater proportion of such trees appears to have been accepted and planted at times where nursery stock was in great demand. The reason for their weakness was clearly manifested. A number were dug up and showed poor rooting-systems, some with scarcely any at all. One in particular showed four separate attempts by grafting and pruning to get a main shoot to come away; the stem was not straight, but zigzagged, and the tree about one-quarter the size of those planted at the same time.

Feeble trees are a menace to healthy ones. They are more quickly further debilitated by any temporary unfavourable condition from which others might recover. Similarly, they were found to be more readily attacked by sour-sap, the spores of which would then doubtless pass to other trees as soon as the opportunity offered. The failure to eliminate defective nursery stock at the time of planting has in some cases been the source of much debility amongst the trees of young orchards. In general, however, the occurrence of such trees, though comparatively small in each orchard, is common throughout most young orchards.

4. *Unsuitable Varieties.*—It can scarcely be said that the unsuitability of varieties to a locality in itself predisposes the trees to the attack of sour-sap. The bark, however, of Cox's Orange Pippin was often dull and bleached in appearance, the trees small for their age, and disease was particularly prevalent amongst them. If the unsuitability of this variety in itself was insufficient to induce sour-sap, it appears at least to have done so when accompanied by other factors operating against the health and vigour of the trees.

As so much land is now planted, much valuable information might be secured for future guidance by a careful study of the merits and demerits of the principal varieties in respect to their growth, productivity, and susceptibility to disease.

5. *Bad Planting.*—Sour-sap was found on trees undoubtedly primarily weakened by bad planting. The roots of some affected

trees were found to be all on one side. Bad planting was seen to lead to rocking in the wind, thus preventing the extension of the rooting-system. Planting too deeply is also a notable defect, and can reasonably be associated with sour-sap. The lower the roots are in the soil the more they are subjected to excessive water and scarcity of air. Good nursery stock can thus be weakened by too deep planting. The spreading of the roots of young trees is essential to their firm establishment in the soil, and the formation of root-hairs takes place best in the warm well-ventilated soil near the surface. Trees should be planted at about the same level as they stood in the nursery rows.

6. *Lack of Shelter.*—An outstanding character of the districts visited was the lack of shelter. In this connection the trees were sometimes found loose at the base from the effects of wind and rain. In another place the effects of sour-sap were observed as distinctly worse on the side of the prevailing wind, which was also the sunny side. No definite evidence is at hand of the direct connection between sour-sap and wind-effects, but where shelter has been provided young trees seemed to profit considerably. At all events, if a heavy storm occurred only once every seven years at fruiting-time it would pay to put in shelter.

7. *Pruning.*—There is much evidence of sour-sap arising from the methods adopted in pruning. Various fructifications associated with the disease were frequently found on the butt ends which had been left when pruning off undesirable shoots, and such shoots had been sometimes forced into growth by too severe pruning last season. If a shoot is to be removed it should be cut off close up to the branch or stem from which it arises, and in pruning leaders the cuts should be made close to the topmost bud it is intended to leave, not midway between buds. The wounds then callous over as rapidly as possible. When butts are left to spread the framework of certain young trees, the wounds may be painted (see page 59 of January, 1914, *Journal*). Butt ends, however, when left may never heal, but furnish dying or dead wood tissues where fungi may gain a footing upon the trees. Certain fungi, notably *Nectria cinnabarina*, gain admission through such wounds. It is worthy of note that cuts made at right angles close to buds heal more slowly than those cuts made obliquely in the same position.

It has not yet been proved by inoculation tests, but it seems highly probable, that sour-sap may be carried by the pruning-shears. In several trees the progress of the disease was clearly from the ends of leaders downward, and in others the "pink cushions" (stromata) were found between the wood and bark at

the tips of pruned leaders and nowhere lower down. There, moreover, the bark, wood, and pith were browned with disease right through. As the disease was traced downward it was less severe —disappearing in the wood earlier than in the bark—until at the base of the tree perfectly healthy bark was found. Further evidence of the direction in which the disease had travelled was found in the bud-development. Instead of the topmost buds having developed most of all, they had not even shown signs of swelling. Lower down, however, a few leaf-spurs had burst; they were evidently checked by the disease a little later than were the topmost buds. The trunk and roots were perfectly healthy.

It is suggested than in pruning a belt might be worn carrying a small tin holding a piece of cotton-wool or waste saturated with kerosene. The shears might then be rapidly sterilized by dipping them in the tin from time to time.

The bad practice of throwing the prunings in a heap, where they often are overgrown by grass and slowly rot away, was met with in not a few cases. Careful examination of such prunings revealed pink cushions producing an abundance of spores, and in the ordinary course winter spores would later be produced. The neglect to burn up the prunings and rubbish of the previous season is a likely reason why sour-sap was the particular form of fungus which early this season attacked, and often killed, young trees after they had been weakened by one or more unfavourable circumstances.

8. *Sundry Causes and Remedies.*—In concluding the remarks on causes of debility, passing notice must be taken of the following: Spray injury to the leaves last season caused weakness this year; the use of poor materials and failure to accurately measure the ingredients or to test the mixtures before use was sometimes the reason. Soil acidity, by the rough test obtainable with litmus paper, was shown to be common; this is worthy of more careful investigation, and, if necessary, lime should be employed, and basic fertilizers substituted for the acid ones more commonly used. Wounds caused by hares—a common trouble—lay the trees open to the attack of fungi. Where practicable, strips of some cheap material or wire netting may be placed round the trunks to catch their claws and prevent damage; the trunks and lower limbs may be painted with fresh blood, which has also prevented hare injury. Hare-proof fences, when kept in good repair, do away with the necessity for these precautions. Old and neglected orchards showed an abundance of disease — not infrequently pink cushions producing spores. There is a real need foı the renovation or complete destruction by fire of neglected and unprofitable trees.

(TO BE CONTINUED.)

BRANCHING-HEADED RYE-GRASS.

A. W. GREEN, *Manager, Ruakura Farm of Instruction.*

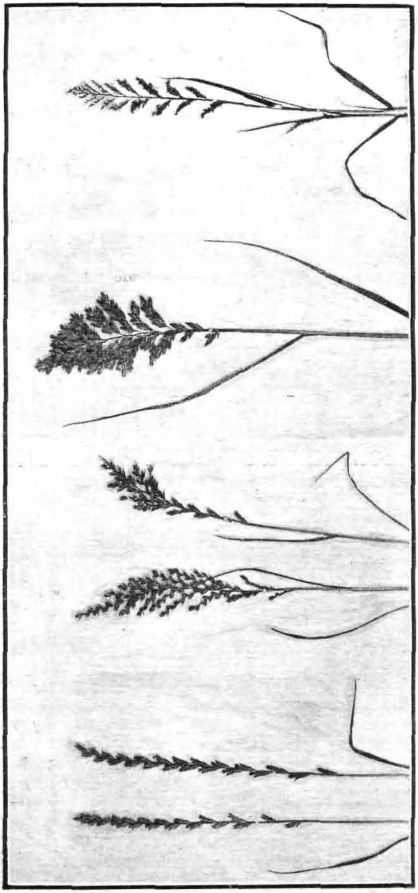
THE success which has attended the efforts of many plant-breeders during the last decade in this and other countries is likely to lead one to expect higher improvements in plants than is reasonable or even probable. In a preliminary remark, therefore, let me correct any false idea which may arise in some minds that a rye-grass producing branching heads is a decided improvement.

The development of a branching head certainly suggests a greater yield of seed per head, but this is not necessarily per plant. Further, excessive seed-development usually leads to plant-exhaustion, and therefore less leafage. Every farmer has experienced this, and places the value of rye-grass on the amount of feed, not seed, produced.

Many points, then, must be taken into consideration before expressing an opinion on the advisability of reproducing plants of this nature. The plant-breeder is no doubt liable to overlook the economic side when something possessing wide variations meets his eye. His one aim is to collect, investigate, and search out, if possible, the cause of the variation. The result which such a variation might lead to comes as a second thought, for few realize how numerous are the failures and disappointments in connection with plant-selection.

Thus to build on results surmised frequently adds further disappointment. In regard to this particular case, results which might be expected from rye-grass bearing branching heads are not in agreement with those which actually take place. To sow the seed gathered from these heads with the hope that every resultant plant will produce similar heads would be beyond the expectation of the most ardent investigator.

Recent experiments undertaken by the writer at Ruakura prove that rye-grass plants bearing branched heads seldom throw more than 10 per cent. of progeny possessing similar characters. Many of these may be found producing individually heads of both ordinary and branched types. It is a significant fact that plants bearing branched heads have a tendency to produce ordinary



BRANCHING-HEADED RYE-GRASS.

From left to right: 1. Normal heads of rye-grass. 2. Heads branched and producing well-developed seeds. 3. A much-branched head producing an unusual quantity of good seed. 4. A much-branched barren head.

heads after a first cutting. This result has been repeatedly confirmed by examining the second growth of heads. When cut down for a second time, the heads of the subsequent crop are, with few exceptions, normal.

In the third generation, after continued selection of the branching type, many of these heads bearing infertile flowers appear in a few of the selections. In most selections, however, no infertile flowers can be traced.

It must be accepted, after careful comparisons with repeated selections, that plants possessing branched heads are more vigorous than the average plants of rye-grass. The leaves are larger, and the culms thicker and fewer in number. Owing to a decrease in the number of heads arising from each plant, there is a slight difference in the weight of seed harvested.

The accompanying photographs serve to illustrate the extent to which this branching may occur in rye-grass.

CONTROL OF THE FLAX-CATERPILLAR.

THE question of controlling the caterpillar pest (*Xanthorhoe praefectata*) of *Phormium tenax*, especially in those areas supplying flax-mills, has had the close attention of the Department for some time past. It has become increasingly evident that the most feasible and promising line of action lies in attacking the pest from the entomological side, involving the discovery and development of a natural enemy or parasite. The Department has now engaged for this purpose the services of Mr. David Miller, latterly of Dunedin. Mr. Miller has been attached to the Biology Section, and will devote his time more or less exclusively for a year or more to a thorough study of the problem. He is now making preliminary investigations in the Manawatu flax-milling district, and will subsequently practically live in the flax-swamps for certain periods. It may be mentioned that Mr. Miller has been engaged in entomological work in the Dominion for some years past, and had latterly undertaken a special study of the flies (Diptera) of New Zealand. He brings enthusiasm as well as training and experience to his present task, the economic aspect of which in relation to the flax-milling industry is of the greatest importance.

GOAT'S-RUE (GALEGA OFFICINALIS).

A RECENTLY GAZETTED NOXIOUS WEED.

A. H. COCKAYNE, Biologist.

THE Noxious Weeds Act that has now been in operation for over sixteen years makes it obligatory, under pain of certain penalties, to prevent the flowering of certain specified plants. Some of these —namely, those included in the Second Schedule—are "noxious" under the meaning of the Act over all parts of New Zealand. Others are "noxious" only in certain districts when so declared by the local authority, such plants being specified in the Third Schedule of the Act. A plant recently added to this schedule is goat's-rue (*Galega officinalis*). As this plant is at present confined to certain special localities and is unknown to the bulk of New Zealand farmers, the following description and general account both of its harmful and useful qualities has been prepared for general information.

OCCURRENCE IN NEW ZEALAND.

Goat's-rue has a very peculiar distribution in New Zealand, being naturalized only along the beds and old alluvial flood-plains of the Manawatu and Pohangina Rivers. It is, however, quite regularly cultivated as a garden-plant in many parts of the Dominion, and only in the districts noted above has it spread beyond the bounds of the flower-garden.

The plant was first recorded as naturalized by the late Mr. H. J. Matthews, Government Chief Forester, about eighteen years ago, and he reported that it was to be found in patches along the river-bed of the Manawatu from the vicinity of Woodville to near Palmerston North. At the present time it is abundant from the Pahiatua district to Foxton, being mainly confined, however, to the banks of the Manawatu River and the land likely to be inundated by its flood-waters. Apart from this it is also spreading rapidly along roads that have been metalled with gravel from the Manawatu and Pohangina Rivers. No doubt floods, by washing out plants and depositing them further down stream, have been a potent factor in distribution. The transportation of seeds and pods by freshes, with their deposition on low-lying land adjacent to the rivers, has also been the means of spreading the plant over fairly wide areas. As goat's-rue is not normally eaten by stock

sufficiently to prevent flowering, a great deal of seed is annually produced, and when once a plant becomes established it spreads rapidly unless the ground is very completely covered with a thick sward.

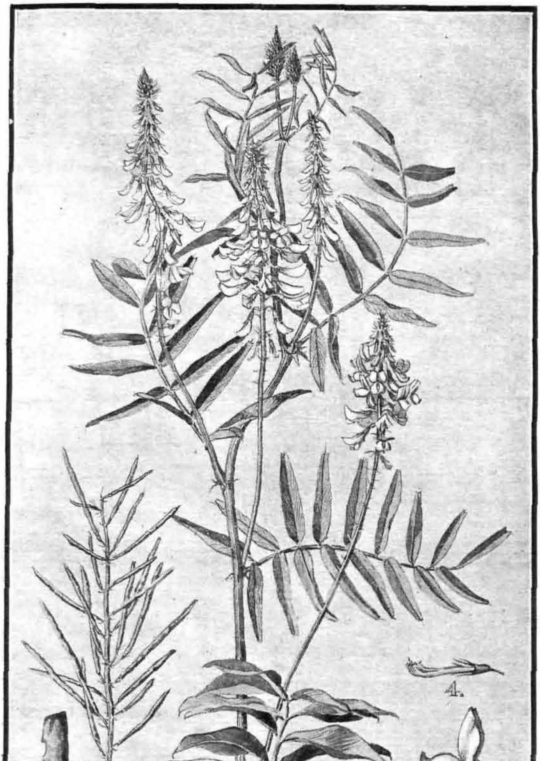
DESCRIPTION.

Goat's-rue is a tall perennial herb with a deeply descending tap-root, while from the crown spring a number of hollow-branched stems 3 ft. or 4 ft. in height.

The leaves are pinnate, and in general appearance not unlike those of a vetch or tare, though they are much larger, and the midrib of the compound leaf is terminated by a single leaflet, instead of by a tendril as is usually the case with the vetches. The radical leaves—*i.e.*, those springing from the base of the main stems—are up to 1 ft. in length and have rounded leaflets; those borne on the stems are smaller and have narrower leaflets. In all cases the midrib of each leaflet is produced beyond the leaf-blade and forms a long point. The stipules, or small leaf-like processes which occur at the bases of the stalks of the compound leaves, are of two kinds: those of the radical leaves are lance-shaped and attached to the leaf-stalks, while the upper stipules more or less encircle the stem, and, owing to their being divided into fine pointed teeth, have a somewhat ragged appearance. The leaves are rather dull green in colour on their upper surface and are usually lighter below. The younger leaves are provided with silvery hairs along their margins.

The flowers are arranged in loose tapering spikes borne on stalks springing from the leaf-axils, and are longer than the leaves. The flowers are about ½ in. long, and in general appearance may be compared with those of lucerne, though they are much larger. There is often very considerable variation in colour, and forms with pure-white or bright-red flowers are the ones generally cultivated in gardens. The general colours of the flowers in the Manawatu district are of two shades of lilac—one dark and the other light. White-flowering specimens are also found. Each flower is shortly stalked, and where its stalk joins the axis of the spike is provided with a long pointed bract, which is very persistent, and remains almost until the fruit has ripened. When the flowers are in young bud these bracts quite overtop them, giving the newly developed racemes and the tips of the older ones a curious bristling and tufted appearance.

The pods, which when ripe are dark brown in colour and up to 1½ in. in length, are long, narrow, more or less cylindrical in section, and generally slightly narrowed or constricted between the



GOAT'S-RUE (*Galega officinalis*).

seeds. Of the latter there are from three to seven in each pod; they are not unlike those of lucerne both in shape and colour, and are larger and straighter, and considerably squarer at the ends.

HABIT OF GROWTH.

Goat's-rue is an extremely vigorous grower, and often attains a height of from 3 ft. to 4 ft. A single plant is capable of spreading over several square yards, although the actual crown may only occupy a few square inches. The branches, owing to their weight, often become more or less decumbent, and in this way the space occupied by a single plant may become very large. The shoots are very densely covered with foliage, and, by excluding the light, plants rapidly choke out the vegetation over the area they are covering. In the winter very little growth takes place, and the plant is virtually herbaceous. In winter seeds that have fallen germinate freely, and fresh plants are developed on the bare areas where the vegetation was killed out the previous year. In this way a large patch many yards in diameter is likely to be produced from a single plant.

Goat's-rue generally comes into bloom about the third week in December, and, when untouched, remains in flower about two months. If cut down just previously to flowering in December it comes again in bloom about the end of March, and at times three flowering stages will be produced in a single season if the plants are kept cut at intervals. This capability of rapid growth after cutting renders the usual method of controlling "noxious" weeds, by means of a single annual cutting, of comparatively no value. In order to conform with the Act, and prevent flowering, grubbing below the crown becomes necessary.

In general appearance goat's-rue is not unlike exceptionally vigorous lucerne, and, like the latter, is an extremely deep-rooted plant. Being a member of the clover family, it is able by means of the bacterial nodules developed on the roots to increase the nitrogen supply in the soil. So far as its beneficial effect on the soil is concerned, its action is similar to any other leguminous crop.

NOXIOUS QUALITIES.

The most important objectionable characteristics of goat's-rue are its unpalatability to stock, combined with its propensity for choking out more desirable vegetation, and its reputedly poisonous properties.

In the late autumn and winter months, when the shoots begin to dry off, stock feed sparingly on the plant, and also in the

early spring before the shoots become tough. In general, however, it can be said that during summer, when the plant is in full vigour, stock of all descriptions refuse the herbage. Thus grass paddocks which may become infested with goat's-rue are reduced in carrying-capacity owing to the lessening of the surface available for the development of grass.

The unpalatability of goat's-rue is shared by many other clover-like plants, such as the melilots and burr clovers, and seems to be due to the bitterness of the foliage. In the case of goat's-rue, again, there is evidence that at certain seasons of the year the foliage is distinctly poisonous to sheep, and perhaps also to young cattle. This fact may have an important bearing on the reason why stock generally reject it, as farm stock in general have a wonderful natural instinct for refusing to graze on plants that are likely to injure them. Moussu and Desaint, in France, have reported the deaths of fifty-seven sheep due to eating *Galega officinalis*, while eighty others in the same flock were also badly affected. Ecchymoses were found in the walls of the alimentary tract, and in the fatal cases a large amount of serum had collected in the pleural cavity. In subsequent experiments it was found that 10 lb. of the green leaves were sufficient to poison a sheep. The plant, however, did not seem to be in the least poisonous to rabbits. In New Zealand several instances of ewes suddenly dying on fields where *Galega* was abundant have been reported, but whether or not the mortality was due to this plant was not determined. It seems clear, however, that the foliage of *Galega* does possess toxic properties, and this must be looked upon as the worst characteristic of the plant.

USEFUL PROPERTIES.

After showing that goat's-rue is not generally eaten by stock, and when so eaten is likely to cause mortality, it would not be expected that the plant should have been recommended from time to time as a valuable forage plant. Such, however, is the case, and in Stebler's standard work on the best forage plants goat's-rue is given quite an important place. As early as 1773 Krause recommended it highly, and at the present day it is regularly grown in various parts of Switzerland. It is there utilized as a green-forage crop, and is cut and fed to cattle before the stems get hard. Apparently no injury results, and the cattle appear to relish the herbage when cut and slightly wilted. In New Zealand no experiments on feeding cattle with *Galega* cut and slightly dried have been carried out, and it is probable that the plant might prove quite useful in this way.

I am inclined to think that goats'-rue might be found an excellent plant for green-manuring purposes. The ease with which it is established, its rapid growth, and the immense weight of herbage produced are all in its favour for this purpose. In addition, it grows luxuriantly on very light sandy soils, and I would not be surprised if it surpassed the lupins for green-manuring on such land. The only doubtful point is whether ploughing in would kill the plants or not The roots are noticeable for the size and number of nodules produced, so that *Galega* is well suited as a soil-renovator from the nitrogen point of view.

CONTROL.

In districts where the local authority declares goat's-rue to be a noxious weed it will be obligatory for farmers to prevent the plant from flowering. As has been already pointed out, mere cutting only acts in the same way as it does on such a crop as lucerne, and a fresh growth, finally developing flowers, follows the cutting-down of the plant. Such a process might have to be repeated three or more times in a season to prevent flowering. In paddocks which are not wanted to be broken up the plants should be grubbed below the crown in early spring, and the ground previously occupied by the plants sown with a grass mixture composed mainly of cocksfoot and Italian rye. This, combined with heavy stocking at intervals, should prove effective. Where goat's-rue is particularly abundant the breaking-up and cropping of the land is suggested.

SELECTION OF POTATO-SEED.

J. BEVERLEY, Assistant Plant-breeder.

SUMMER-TIME may seem somewhat early to think about potatoes for the next season, but there is far more importance attaching to the matter than appears on the surface.

Seedsmen do not always grow their own stocks, but supply the seed to farmers, who grow them at so-much per ton or by the acre. There is nothing against this system if reliance can be placed on the grower. The latter, however, generally aims to get the biggest crop, and it is therefore unlikely that he will make the rigorous selection which is of so much importance unless the seedsmen enforce it under the conditions of contract.

One hears of varieties sporting different flowers, but this is due more to previous lack of care in roguing than anything else.

When potatoes are in flower it is advisable to look the crop over and fork out the wrong varieties, which may be used for table purposes. For example, in a field of Up-to-Dates white-flowering sorts would be rogues and should come out. Pure seed is worth more than a mixed lot; in order to make a reputation for sending out pure seed one must, therefore, be careful in roguing. It is also necessary to cull out weak and undesirable roots at the same time; by so doing the quality of the seed is improved.

I would advise small growers to select their own seed whilst the variety is in full vigour, just after flowering; in other words, *to obtain immature seed, sufficient for their own requirements,* from the best roots or hills. There is a big demand in England for Scotch seed potatoes, which are partially immature, as the frosts generally cut down the haulm of the main-crop varieties before maturity is reached. When a change of seed is necessary it is best to obtain it from a colder or a later district, and, when purchasing, to make inquiry where it was grown.

Change of seed every second year is advocated by many people as being beneficial to the general crop. Others, however, find that abundant crops of sound tubers can be grown for years from self-saved seed, if only the plant is well cultivated and a little care is exercised in selection and proper storing over winter.

Potatoes produce best in moist, cool climates, such as their original home on the plateaus of the Andes. Hot, dry weather at the time of maturity weakens them for reproduction, and after such weather the disease which the Americans call "spindling sprout" is often troublesome. Tubers affected with this disease either refuse to sprout or give weakly growths almost like cotton. If the boxing system is adopted, all the affected tubers can be removed before planting-time, which is an advantage. The disease mentioned has been common in the south of England for some years, being known as "potato bacteriosis." Many theories respecting the cause have been advanced; one is that the starch of the tuber not being converted to sugar fails to provide the plant-food necessary for the sprout to feed on and develop. Immature seed is mostly free from the disease.

As regards the size of tubers for seed, I advise a 2 oz. set. If riddles are used to grade the seed through a 1¾ in. and over, a 1½ in. mesh gives a useful size for main-crop varieties.

The storing of seed is a most important matter. Wire benches under pine-trees are used at Moumahaki, thus ensuring sufficient light, plenty of air, and freedom from frost during the winter.

CERTIFICATE-OF-RECORD COWS.

W. M. SINGLETON, Assistant Director, Dairy Division.

The table below completes the list of records made to the end of December, 1915. A number of these records are worthy of special comment, but on this occasion, owing to exigencies of space, we must leave the figures to speak for themselves.

In the Friesian list appear the names of Miss Wood and Lady Wood as owned by Mr. C. A. Hopping. These cows were purchased by the present owner from Mr. M. Leith, of Woodlands. It is fair to state that these cows made their yield while in Mr. Leith's possession and under Southland conditions.

LIST OF RECORDS.

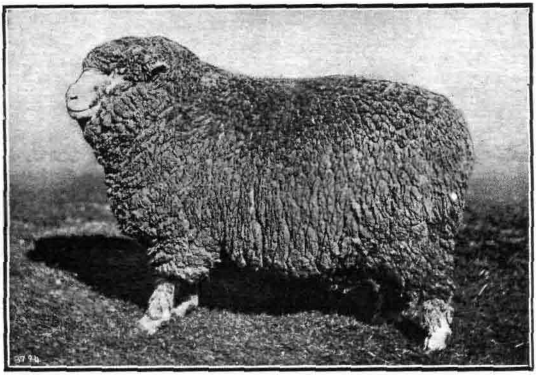
Name of Cow.	Name and Address of Owner.	Age at starting Test.		Fat req'd for Cert.	Yield for Season.		
					Days.	Milk.	Fat.
	JERSEYS.						
Two-year-old Class.		Yrs.	dys.	lb.		lb.	lb.
Lady Molina ..	F. E. Hellyer, Dunedin	2	0	240·5	365	7201·90	415·06
Molina's Redwing ..	" "	2	2	240·7	365	7614·60	455·82
Golden Swan's Girl..	H. Moreland, Papatoetoe	2	333	273·8	295	8218·25	374·81
Golden Swan's Lilac	A. Moreland, Papatoetoe	1	339	240·5	365	5839·75	314·60
Dorothea	A. Guy, Palmerston North	2	202	260·7	365	6467·00	459·12
Miro Meadow's Rata	E. Veale, Cambridge ..	1	280	240·5	363	7206·00	401·18
Polly	A. A. Ward, Miro ..	2	326	273·1	365	6801·30	409·22
Eminent's Maggie ..	C. G. C. Dermer, Waipiko	2	363	276·8	365	11103·00	572·13
Eminento	A. Banks and Son, Kiwitea	2	338	274·3	365	7133·00	290·70
Verona	C. Stevens, Maungatapere	1	344	240·5	321	4255·20	241·64
Three-year-old Class.							
Little Champ II ..	S. R Lancaster, Palmerston North	3	67	283·7	365	8415·50	454·53
Four-year-old Class.							
Belvedere Bilberry ..	E. Griffiths, New Plymouth	4	91	322·6	310	7550·00	411·33
Lady of Collingwood	F. E. Hellyer, Dunedin	4	86	322·1	365	12096·50	736·07
Mature Class.							
Day Dream ..	H. Purdie, Brixton, Taranaki	7	30	350	340	11915·27	488·55
Enigma	*Ditto*	8	266	350	365	9719·10	504·08
Lenora	C. G. C. Dermer, Waipiko	6	48	350	365	11115·40	685·18

LIST OF RECORDS—*continued.*

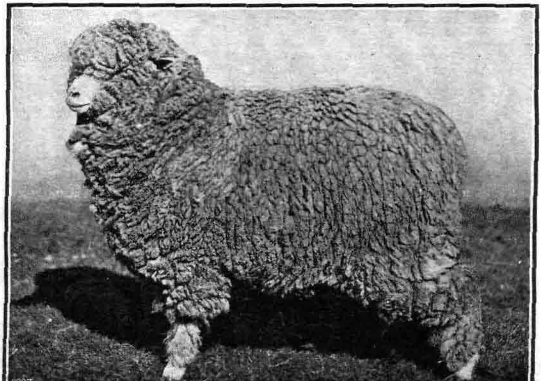
Name of Cow.	Name and Address of Owner.	Age at starting Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	FRIESIANS.					
Junior Two-year-old Class.		Yrs. dys.	lb.		lb.	lb.
Longbeach Dutch Lassie	Barrow Bros. and Ellis, Kiwitea	1 336	240·5	365	7958·10	296·68
Senior Two-year-old Class.						
Woodcrest Johanna Tekee	John Donald, Westmere	2 243	264·8	365	14504·20	544·94
Holland Lassie ..	H. North and Sons, Omimi, Seacliff	2 358	276·3	332	11229·70	398·73
Junior Three-year-old Class.						
Heilo Oak Burke Lyons	W. Barton, Featherston	3 131	290·1	365	12900·50	396·54
Lady Minnewawa ..	W. I. Lovelock, Palmerston North	3 55	282·5	365	13984·00	483·39
Senior Three-year-old Class.						
Miss Wood ..	C. A. Hopping, Palmerston North	3 355	312·5	365	14065·50	517·66
Bonny Belle Lady ..	Hy. Johnson, East Road, Stratford	3 274	304·4	365	10228·40	334·97
Senior Four-year-old Class.						
Monona Indi Surprise	A. J. Gallichan, Tiakitahuna	4 335	347·0	365	14163·00	428·34
Mature Class.						
Longbeach VII ..	Neil Carter, Netherton, Thames Valley	7–8 years	350·0	299	16226·70	566·29
Lady Wood ..	C. A. Hopping, Palmerston North	5 310	350·0	365	15226·40	536·36
de Kol Hengerveld Belle IV	W. I. Lovelock, Palmerston North	5 239	350·0	365	12586·90	483·16
	AYRSHIRES.					
Four-year-old Class.						
Dominion Fenwick Maggie	*Government Experimental Farm, Moumahaki*	4 113	324·8	321	10886·70	388·95
Mature Class.						
Minnie of Glenweir ..	Weir Bros., Pukehiki, Dunedin	7 69	350·0	326	10543·80	476·29

A practical demonstration of reserve carrying-capacity has been afforded at the Department's Ruakura Farm, where for four weeks during January and February an average of one hundred military remount horses has been grazed without reducing the large numbers of ordinary stock on the place or stressing the farm in any way. For the dairy herd, calves, pigs, &c., there has been, in addition to pasture, an abundance of lucerne, maize, and other green forage, while a stack of sorghum ensilage is also being effectively utilized.

NEW ZEALAND SHEEP AT PANAMA PACIFIC EXHIBITION.



QUALITY IV: MR. C. H. ENSOR'S CHAMPION CORRIEDALE RAM.



CHAMPION CORRIEDALE EWE: MR. C. H. ENSOR'S LUCK BRAND.

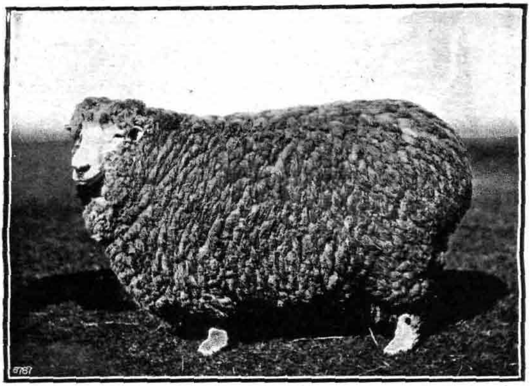
NEW ZEALAND SHEEP AT SAN FRANCISCO.

CIRCUMSTANCES did not allow of the photographing of the New Zealand sheep forwarded for competition at the Panama Pacific Exhibition prior to the sailing of the vessel from Wellington for San Francisco last September. At the request of the Department, however, the New Zealand Commissioner had the animals photographed at San Francisco, the pictures being taken in the Exhibition Grounds. In this issue of the *Journal* are reproduced from the series photographs of Mr. Ensor's champion Corriedale ram and ewe, Mr. Matthews's champion Romney, and Mr. Perry's reserve champion of the same breed. A group is also given of Mr. Perry's four Lincolns, the judging of which has been widely discussed. Writing after the declaration of the awards, Mr. Clifton, New Zealand Commissioner, remarked as follows: "The four Lincolns, the property of Mr. William Perry, of Masterton, did not receive the award they merited, two fourth prizes only having been awarded. These Lincolns are not of the type fashionable here. The American flockmaster appears to prefer the sheep of a smaller size with a finer and softer wool; the wool of ours was described as too coarse. But actually there is no comparison in the sheep. The New Zealand sheep are big, weighty animals with heavy fleece, admittedly coarse wool, and in heavy locks. The American sheep exhibted were smaller, the wool undoubtedly finer, the fleece comparatively light, and the sheep failed to exhibit the strong robust constitution of those shown by Mr. Perry. Although these sheep did not receive greater awards they are really appreciated by many of the American flockmasters, and among them are those who consider that the judge was wrong in his decisions."

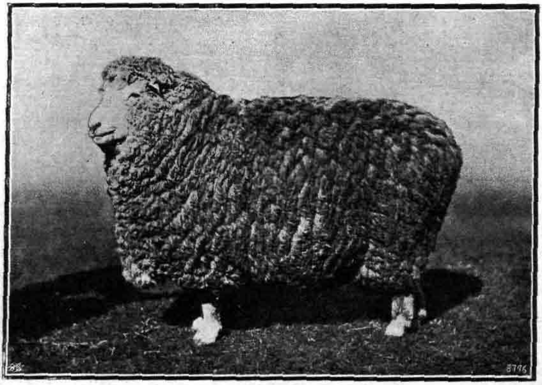
Particulars of all the awards gained by New Zealand sheep at the Exhibition competitions were published on page 535 of the December *Journal*.

The president of the National Woolgrowers' Association of America, in the course of an address to the annual conference of that body recently held at San Francisco, remarked as follows: "We Americans who have had the pleasure of seeing the New Zealand display of wool in bale and lock form at the Exhibition ought to be ashamed to admit that we are in the wool business. To all intents and purposes we are simply not in it. The New Zealand exhibit is absolutely the finest show of wool that has ever been seen in America. We are too circumscribed, and must educate ourselves on the progressive lines of New Zealand." The utterance was applauded by the conference.

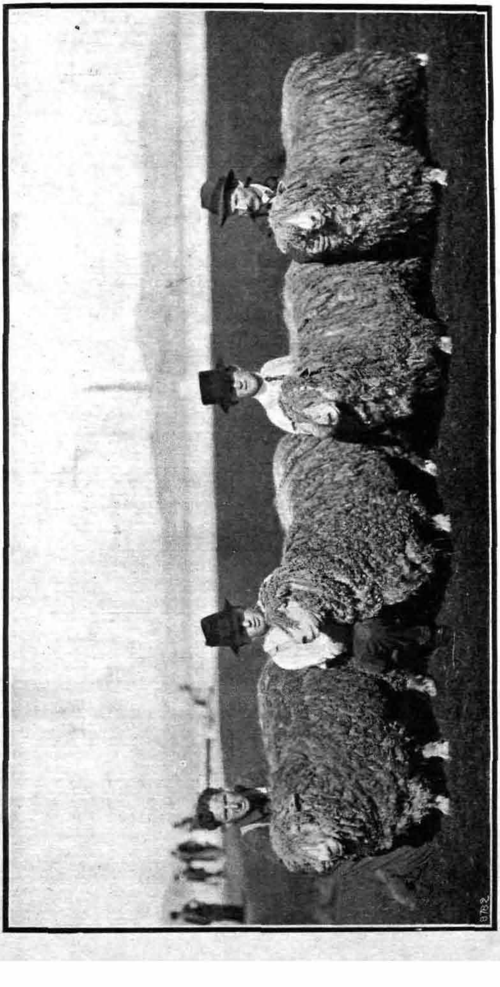
NEW ZEALAND SHEEP AT PANAMA PACIFIC EXHIBITION.



MR. ALFRED MATTHEWS'S CHAMPION ROMNEY RAM, NO. 5936, NEW ZEALAND ROMNEY MARSH FLOCK BOOK.



MR. WILLIAM PERRY'S RESERVE CHAMPION ROMNEY RAM, NO. 6653, NEW ZEALAND ROMNEY MARSH FLOCK BOOK.



MR. PERRY'S LINCOLN RAMS.

From left to right the sheep are as follows: Napier IV, fourth prize for rams two years and over; Big Chief, fourth prize in class for one year and under two; Chief IV and Rangatira VIII, unplaced in class for one year and under two. (See comment on page 135.)

POULTRY-FEEDING WITHOUT WHEAT.

THE MILTON EXPERIMENT.

TABULATED below are the latest recorded results of the feeding experiment which is being conducted at the Department's Milton Poultry-station for the purpose of testing the effect as regards egg-production of eliminating wheat from the ration (substituting oats and chaffed lucerne).

It will be seen that during the third period of twelve weeks the value of the eggs laid by the birds fed without wheat was 3s. 7·16d. in excess of that of the wheat-fed pens. The cost of production, however, was in favour of the latter by 2s. 4·51d., thus reducing the difference in gross profit to 1s. 2·66d. only.

The results for thirty-six weeks recorded to the 7th January show that the two classes of pens are still keeping very even, although the value of eggs laid, cost of production, and gross profit are now all slightly in favour of the wheat-fed birds.

Details of the first two periods, and other particulars regarding the test, were published in the *Journal* for August and November last respectively.

FEEDING EXPERIMENT AT THE MILTON POULTRY-STATION.—RESULTS FOR THIRD PERIOD OF TWELVE WEEKS, ENDED 7TH JANUARY, 1916.

Record of Eggs laid.

Week ended	Birds fed with Wheat.		Birds fed without Wheat.	
	White Leghorns. (Pen No. 1.)	Brown Leghorns. (Pen No. 2.)	White Leghorns. (Pen No. 3.)	Brown Leghorns. (Pen No. 4.)
Oct. 22 ..	32	33	30	35
,, 29 ..	35	34	34	25
Nov. 5 ..	30	36	37	32
,, 12 ..	32	35	29	34
,, 19 ..	29	25	29	34
,, 26 ..	21	27	25	33
Dec. 3 ..	19	26	29	30
,, 10 ..	23	31	29	34
,, 17 ..	25	35	27	36
,, 24 ..	30	36	30	32
,, 31 ..	31	37	33	35
Jan. 7 ..	18	37	29	33
Totals ..	325	392	361	393
Previously laid	778	610	742	602
Grand totals..	1,103	1,002	1,103	995

Number and Fair Market Value of Eggs laid.

Pens.	Eggs laid.	Value at 1s. 2d. per Dozen.	Average Eggs per Bird.	Average Value per Bird at 1s. 2d. per Dozen.
		£ s. d.		s. d.
No. 1 ..	325	1 11 7·16	54·16	5 3·19
No. 2 ..	392	1 18 1·33	65·3	6 4·22
No. 3 ..	361	1 15 1·16	60·16	5 10·18
No. 4 ..	393	1 18 2·5	65·5	6 4·41

Particulars of Foods used.

Food.	Pens Nos. 1 and 2.		
	Average Price.	Quantity used.	Cost.
	£ s. d.	lb.	£ s. d.
Pollard	7 14 0 ton	67	0 5 1·9
Bran	5 7 0 ,,	24	0 1 3·4
Maize	0 4 10 bushel	17	0 1 5·6
Meatmeal	0 14 0 cwt.	24	0 3 4·32
Wheat	0 5 3 bushel	117	0 10 2·85
Totals	..	249	1 1 6·07

Food.	Pens Nos. 3 and 4.		
	Average Price.	Quantity used.	Cost.
	£ s. d.	lb.	£ s. d.
Pollard	7 14 0 ton	61	0 4 8·36
Bran	5 7 0 ,,	21	0 1 1·48
Maize	0 4 10 bushel	17	0 1 5·6
Meatmeal	0 14 0 cwt.	24	0 3 4·32
Oats	0 3 6 bushel	108	0 9 5·4
Lucerne	8 0 0 ton	53	0 3 9·42
Totals	..	284	1 3 10·58

Comparative Summary.

Pens.	Value of Eggs laid.	Cost of Production.	Gross Profit.
	£ s. d.	£ s. d.	£ s. d.
Nos. 1 and 2	3 9 8·49	1 1 6·07	2 8 2·42
Nos. 3 and 4	3 13 3·66	1 3 10·58	2 9 5·08
Differences ..	0 3 7·16	0 2 4·51	0 1 2·66

RESULTS FOR THE THIRTY-SIX WEEKS ENDED 7TH JANUARY, 1916.

Period.	Pens.	Value of Eggs laid.		Cost of Production.		Gross Profit.	
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Twelve weeks ended—							
July 23	1 & 2	4 9 11·80		1 5 4·50		3 4 7·30	
Oct. 15	1 & 2	4 3 2·75		1 0 10·07		3 2 4·68	
Jan. 7	1 & 2	3 9 8·49	12 2 11·04	1 1 6·07	3 7 8·64	2 8 2·42	8 15 2·40
July 23	3 & 4	4 12 6·90		1 4 2·25		3 8 4·65	
Oct. 15	3 & 4	3 16 10·50		1 1 2·65		2 15 7·85	
Jan. 7	3 & 4	3 13 3·66	12 2 9·06	1 3 10·58	3 9 3·48	2 9 5·08	8 13 5·58
Differences ..	..		0 0 1·98		0 1 6·84		0 1 8·82

LAMBING PERCENTAGES.

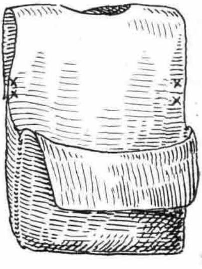
ESTIMATES of the lambing percentages for the current season in their respective districts have been furnished by the Department's Stock Inspectors as tabulated below, together with the figures for 1914. Comparing the two seasons, it will be noted that in 1915 twenty-one districts show a decrease and nine districts an increase, while two are stationary. The net result is a decrease of 5·1 per cent. for the whole Dominion. The 1915 figures were arrived at after careful inquiry, and should be a good indication of the position.

LAMBING PERCENTAGES, 1914 AND 1915.

District.	1915.	1914.	District.	1915.	1914.
		North Island.			
	Per Cent.	Per Cent.		Per Cent.	Per Cent.
Ohaeawai ..	83	87	Opunake ..	89	91
Whangarei ..	75	85	Stratford ..	88	92
Auckland.. ..	87	95	Hawera.. ..	93	93
Hamilton.. ..	106	100	Wanganui ..	90	100
Te Kuiti	85	90	Feilding.. ..	98	103
Tauranga.. ..	75	70	Palmerston North	90	94
Wairoa	80	75	Woodville ..	90	100
Gisborne	90	95	Masterton ..	90	93
Hastings	75	90	Wellington ..	85	90
New Plymouth ..	97½	99			
		South Island.			
Blenheim.. ..	72	65	Oamaru.. ..	75	98
Nelson	78	78	Dunedin ..	85	90
Hokitika	95	90	Mosgiel	70	78
Kaikoura.. ..	91	81	Gore	91	90
Christchurch ..	77	77½	Balclutha ..	93	90
Amberley ..	55	86	Invercargill ..	80	75
Timaru	77	93			

GRASS-SEEDING BAG.

THE grass-seeding bag here illustrated has proved its usefulness, especially for sowing bush-burns. The bag is made from an ordinary sack, which, however, should be a good one. The seams at each side of the sack are cut to half-way down; about one-quarter of the sack-length is then turned back and fastened at the corners to make arm-holes, and a hole is cut on top large enough to go over the head. The result is a yoke and bag combined, which can be readily put on and off as required. The strong features of this bag are its even distribution of the weight on the shoulders, and the fact that it gives the worker the use of both hands to sow with. The type of bag slung over one shoulder is deficient in both these factors.



GRASS-SEEDING BAG MADE FROM AN ORDINARY SACK.

AMENDED BLACKLEG REGULATIONS.

THE regulations under the Stock Act for the prevention of blackleg among cattle were recently amended in order to meet present conditions. Hitherto the operation of these regulations has been confined practically to the Taranaki Province. Owing to the disease having become more or less troublesome of late in certain parts of Auckland, the whole or parts of the following counties in that province have now been declared infected areas: Franklin, Raglan, Piako, Thames, Ohinemuri, Waipa, and Waikato. Farmers, dealers, &c., in these districts should therefore make themselves conversant with boundaries specified, the conditions governing the removal of young cattle therefrom, and the provisions as to vaccination of cattle. Another addition to the regulations provides that, subject to certain specified conditions, young cattle intended for immediate slaughter at a public abattoir or meat-export works may be removed from an affected area without being vaccinated. The full regulations were published in the *Gazette* of the 23rd December last. Further information on the subject may be obtained from any Inspector of Stock.

WORK FOR THE COMING MONTH.

NEW ZEALAND is a country of wide variation in climatic and soil conditions. In applying suggested procedure it is, therefore, necessary for the farmer to amend it to suit local weather-conditions and the requirements of his soil—information which can best be ascertained by a study of these problems on the part of the farmer himself. Nothing can take the place of local knowledge. Little advice on an agricultural subject is capable of general application in its entirety.

THE FARM.

ESTABLISHING PASTURES.

In last month's issue the subject of seed mixtures for bush-burns and permanent pastures was reviewed. It is hoped that the various points dealt with were of service as reminders or suggestions to farmers about to secure their supplies of seeds. The operations involved in sowing the seeds generally fall to be undertaken during March. The preparatory work cannot, indeed, be taken in hand too soon where not already done. Good cultural conditions are the reverse of good seeding conditions. For the former, a hot sun and a dry surface are required to perish all weeds. These conditions prevail generally during January and February. If the necessary cultivation is carried out then, everything is in order for sowing the seeds when light autumn rains may be expected, the soil is warm, and the sun's rays have lost their scorching tendency — the environment favourable to a successful germination and vigorous growth of the future plants, which are thus enabled to get ahead of weeds and to become established before winter sets in.

In an established system of farming the grass lea is looked upon as the restorative period of the rotation. Humus and (through the agency of the clovers) nitrogen increase not only as the result of the accumulation of roots, but also from the droppings of depastured stock. Given proper cultivation, the heaviest and most payable crops are those which follow grass. But pasture in New Zealand, as elsewhere, is a great agricultural asset, not only by virtue of its power of accumulating fertility in this way, but also

because it is in itself the main reliance of the farmer for stock-raising.

Good grass requires the same attention to the laws which govern fertility as any cultivated crop. It will pay equally well. It is, in fact, more important to consider the soil-condition for receiving grass-seeds than for other crops, and that for several reasons. In the first place, pasture seeds are small and pasture plants are slow in their initial growth. Good preparatory tilth is therefore an indispensable condition of a good subsequent sward. In the second place, moisture is frequently the controlling factor in plant-production, and soil moisture is conserved in the soil by humus and by cultivation. When land is in pasture, surface cultivation for moisture cannot be given. Hence it is the more important that there should be an abundant humus-supply in the soil before the pasture is laid down. In the third place, annual crops can be stimulated to satisfactory production by applications of fertilizers being incorporated with the soil when the seed is sown.

In the case of pasture, while top-dressing frequently produces marked effects, the results cannot be compared with those produced by natural fertility arising from the thorough admixture of humus and mineral ingredients thoroughly incorporated in the soil before ever the pasture is laid down. This is readily seen in the general excellence of pastures laid down after well-manured rape, or, better still, a leguminous crop such as clover, peas, or tares, as compared with the frequently defective pasture which follows a cereal crop; while the worst pastures of all are those which are laid down on land which has been cropped out by a succession of cereal crops.

In many parts of the North Island rape can be sown and fed off early enough to enable the land to be prepared timeously for a sowing of grass-seeds. Where this is not possible a good plan is to lay the pasture down after a forage crop, such as barley and peas, or oats and tares, sown in autumn and fed off up to December, when the land can be prepared for grass-sowing. This system has frequently been recommended in the *Journal*.

With regard to the manuring advisable at this stage, the first essential is an adequate supply of lime. Where naturally deficient, this should have been supplied before the rape or forage crop was sown, and brought nearer the surface again by deepening the furrow in ploughing for grass. If this was not done, it would perhaps be better to leave out liming altogether in the meantime and apply it later on in the winter on the surface of the young grass, to be followed by a top-dressing of superphosphate in spring. The manures which may be used now should consist mainly of

slow-acting fertilizers, such as blood and bone, in liberal amount, broadcasted before the last cultivation, together with a small amount of superphosphate applied with the seed.

With regard to seeding operations, having in mind that a uniform fine tilth down to the subsoil is desirable, it will be apparent that there is a danger of getting the seeds too deep in the ground on the one hand, or of depositing them on a dry surface on the other. These difficulties can be obviated by first rolling, then broadcasting the seed, harrowing well with light harrows (preferably with shortened teeth), and rolling again. This generally is the most advisable course to follow. The rolling provides the firm bed desirable for the clovers, prevents the young plants from being unduly weakened or killed by being too deeply buried, and also strengthens the upward capillary rise of water, thus ensuring a moist surface for the germinating seeds. In dealing with these suggestions it must be remembered that conditions vary considerably. For example, in good strong loams which have been well prepared the surface soil will rarely be so loose as to necessitate preliminary rolling before sowing the seeds. All farm operations must be regulated by prevailing conditions.

FORAGE CATCH-CROPS.

Attention is again directed to the necessity for getting in forage crops for winter and spring use, when the pastures will be bare. This important matter cannot be mentioned too often. There are still to be seen thousands of acres of stubble which have not been touched, although the stooks have been removed for some weeks. The harvest has been got through expeditiously, so that labour is evidently not lacking. In any case, in such times as the present, the food-producer should not balk at laborious days. Stubble not intended for catch-crops should be scarified as soon as possible, to spring weeds and scattered grain. On reclaimed, sorrel-infested swamp land it is doubtful if a more satisfactory crop could be grown than Western Wolths rye-grass. Its rapid, vigorous growth enables it to get ahead of the sorrel, and to furnish a palatable bite when other pastures are dormant.

LUCERNE.

Recently sown lucerne may be clipped with the mower and thoroughly harrowed with weighted harrows. Established lucerne should be thoroughly shaken up with the spring-tooth cultivator, and old lucerne renewed by straight-out disking.

CULTIVATION OF ROOT CROPS.

Many farmers seem to think that after singling intercultivated crops, such as mangels and turnips, their labours are over until the crop is ready for use. The prediction contained in last month's notes on this point has proved correct in many cases. An extra turn of the scufflers can be done at a cost not exceeding 3s. per acre, or half that amount where a double-row scuffler is available, and for this outlay it is not too much to say that the farmer can have the satisfaction of harvesting anything from 5 to 20 tons more crop. *Crops that are not too far advanced may still be scuffled if the work is carefully performed.* Even if a few plants are knocked out by the horse or by the implement in use, there will be infinitely less damage done than if the operation is neglected altogether.

POTATOES.

The main crop of potatoes will soon be ready for lifting. Farmers who have good crops without disease should give attention to the saving of seed for next year's planting and for sale for seed purposes. A good economical size of tuber for seed purposes passes through a $1\frac{3}{4}$ in. mesh riddle and is retained over a mesh of $1\frac{1}{2}$ in.

It is believed by many—and there is good evidence to support the belief—that larger crops are grown from immature seed. The storage of immature seed is, however, somewhat risky. When immature tubers are selected for this purpose they should be exposed to the sun for a few weeks until they are greened. This has the effect of increasing the corky tissue round the tuber, with the result that there is less loss of moisture and less risk of decay. High-class seed is procured by individual root selection. Where seed is taken indiscriminately from the clamp without previous selection tubers with incipient disease and tubers from unprolific roots are apt to be included.

STACKS AND THRESHING.

Grain-stacks which are not to be threshed immediately should be thatched properly and the site of stacks ploughed round to provide a fire-break. It is advisable, however, to have the threshing of grain crops pushed on without delay, and the grain carted from the fields before rainy weather sets in, otherwise the cost will be increased and considerable damage done to farm roads and fields.

DRAINS, ETC.

March is a good month for draining swamps and other lands, and if possible all drains should be cleaned out in preparation for the wet season. Similarly, all places in roadways, particularly

near gates and cowyards, which are liable to cut up in winter, should be attended to while the weather is good.

NOXIOUS WEEDS.

The clearing of noxious weeds should be continued. Californian thistle will be running into bloom in the South if not cut back. The second growth of ragwort will want attention. The flower-heads should be cut, gathered, and burned. Clear off any blackberry remaining. The plough is the best means of dealing with this weed, but where cutting has to be resorted to it should be done as near to the ground as possible. All clippings should be collected and burned, as if left on the ground they make subsequent cutting difficult, and where sheep are grazed cause a lot of damage by getting tangled up in the wool.

LIVE-STOCK.

The Stock Act requires that all sheep should be dipped between the 1st January and the 31st March in the North Island, and between the 1st February and the 30th April in the South Island. The requirements of the law should thus be carried out at once in the North Island, if not already done. Four things are essential —a clean muster, fine weather, a good dip well mixed, and sheep properly immersed and allowed to remain one minute in the dip.

Where the culling and sorting-out of ewes has not been attended to it should be done at once. Stockowners generally should aim to get all surplus stock marketed as soon as possible, so as to leave on hand only such stock as can be wintered safely. Rams can be mated with ewes during the month for an August-September lambing. Ewes should be gone through frequently when running with the ram, for where the country is at all rough there is a danger of the rams getting into out-of-the-way corners with a few ewes, with the result that the lambing is very irregular, and many ewes may miss being tupped.

Dairy-farmers who have followed advice given in these pages will now experience the satisfaction of an abundant flow of milk brought about by liberal supplies of green maize. The first break of this fodder, sown about the beginning of December, will have now been used up. It remains for the farmer to continue this system by getting in other crops for winter use as already advised. The prices current for dairy-produce ensure a handsome return for special feeding.

Young dairy stock should be kept in thrifty condition by running them on fresh pasture with good water. A small allowance of crushed oats would also not be amiss. The critical time for this

class of stock is approaching, and a nice piece of sheltered pasture should now be cleared of stock and allowed to freshen with the autumn rains, for their use at the onset of winter.

Foals may be weaned at this period.

VALUATIONS: PLANS FOR THE YEAR.

For purposes of taxation the agricultural year is considered as extending from the 1st April to the 31st March. In other respects also March is a good month in which to review the past year's operations and lay plans for the year's work in prospect. It is every farmer's duty at the end of this month to take an inventory and make a valuation of his holding, improvements, tillages, crops growing and harvested, stock, implements, and equipment of all kinds used in his farming operations. This should be made the basis of a suitable system of cost accounts during the following year.

The preliminary task of reducing to paper the present state of affairs will probably be found useful in other directions. It will reveal deficiencies to be made good, repairs to be effected, precautions to be taken, economies which might be practised—small when separately considered, but important in the aggregate.

FARM LAY-OUT: FENCING.

Quite extensive savings can often be made in connection with fencing for purposes of subdivision and in the farm lay-out generally. The extent to which subdivision should be carried is a very debatable point. Much depends on the quality of the land, amount of cropping, and number and kinds of live-stock. The cost and upkeep per acre of fencing varies considerably according to the size of the paddocks. Two adjacent 50-acre paddocks measuring each 20 chains by 25 chains will require a total of 155 chains of fencing at 1·55 chains per acre. If subdivided into 10-acre paddocks by cross-lines an additional 160 chains of fencing will be necessary—a total of 315 chains, or 3·15 chains per acre. The difference in favour of the 50-acre paddock is 1·6 chains per acre, not including extra gates for the smaller units. Interest and upkeep on this extra fencing might amount to 2s. 6d. per acre per annum. This amount capitalized at 5 per cent. makes the land dearer by £2 10s. per acre. More extreme cases could be quoted.

It is well, therefore, before fencing newly grassed burns or further subdividing open lands to consider carefully whether fencing into very small blocks is advisable. Undoubtedly much greater returns are possible from heavy but intermittent stocking of pasture than with light continuous stocking. The sward is evenly grazed and

the feed is not fouled. This desideratum, however, does not necessitate a network of small paddocks. At the outside, six main paddocks with several small paddocks near the homestead should satisfy most requirements. Where regular cropping is done, small paddocks are a veritable nuisance. Every operation becomes costly. High rates of labour in cultivation can only be met by long rounds and large teams. Chinese methods will not answer in New Zealand.

The shape of paddocks is also important. Irregular shapes should be avoided by every possible device. One-half longer than wide is a good ratio for a cropped paddock. Most operations can be done lengthwise to save turns. Such a paddock, if of reasonable size, is still wide enough for cross-ploughing or cultivating when these operations have to be done. In feeding-off, less netting is required to run crosswise.

The lay-out of the farm as a whole is also of great importance. The ideal arrangement is to have equal areas on either side of a through road or lane, with the homestead in the centre.

Sketching the paddocks approximately to scale on paper and careful study of the lay-out with reference to convenience of working may suggest alterations which could be effected in spare time at a small cost, and which would result in saving time, energy, and money from year to year.

THE ORCHARD.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

SPRAYING.

FROM the point of view of spraying (apart from codlin-moth) the work of the orchard will soon be drawing to a close, particularly in orchards where this work has been properly attended to earlier in the season. Doubtless, however, there are still a number of cases where something more will be required to keep in check such diseases as powdery mildew, woolly aphis, red mite, and leech.

Powdery Mildew.—Where previous instructions have been properly attended to this disease should not be sufficiently in evidence to cause any particular worry, but in many cases there will still be found ample affected twigs and foliage, particulary on the more susceptible varieties, to spread the disease to a greater extent than is desired before the summer is over. It would therefore

be advisable to give the trees at least another dressing of lime-sulphur during the month. In cases where preventive remedies have not been properly carried out the debilitating effect of this disease on the tree will clearly be evident. Although it is now too late to remedy this condition to any great extent, thorough treatment with lime-sulphur should benefit subsequent attempts necessary to eradicate the disease.

Woolly Aphis.—Up to the present all summer treatment for this pest can be considered in the nature of a temporary check only, and has therefore to be repeated at intervals with the object of minimizing the damage that would otherwise be done by the aphis until the colder weather checks the increase of the insects and the tree is sufficiently dormant to allow of the stronger oil sprays being used.

To assist in checking the increase of these destructive insects at this season a free play of air and light should be provided for. Where this work has not already been done dense-growing trees should be opened up by removing all surplus and misplaced growths. This will also allow of more thorough spraying-work being done. Spray all affected trees thoroughly with either resin solution, "Black-leaf 40," or a diluted emulsified oil spray.

Red Mite.—During the months of February and March this very small but pernicious insect is usually to be found at its worst, and where proper remedial treatment has not been attended to its worst is pretty bad. The correct time to wholly eradicate this insect (as also all other soft-bodied insects) from the orchard is whilst trees are in a dormant state. Summer treatment at best will only check them, and to an extent lessen the damage they would otherwise do.

Lime-sulphur, or a nicotine solution, combined with arsenate of lead, and used throughout the summer, will successfully keep the mites under control on apple and pear trees, whilst whale-oil soap will give more satisfaction if only one or two applications are being relied upon, and it can also be applied to stone-fruits safely, and with good results. Resin solution, as recommended for woolly aphis, will also destroy red mite.

Pear Slug or Leech.—Where the remedial treatment for the control of this insect has not been attended to, considerable damage of a serious nature will have been done to the foliage of such trees as the pear, cherry, Japanese plum, &c. The leech is very easily destroyed by the use of arsenate of lead or hellebore powder, applied as previously directed; whilst the damage, if the pest be left unchecked, is often disastrous, especially to young trees. It

is now too late to remedy the evil done under such conditions, as the main season for serious attacks is now past; but it is still advisable to apply either of the above-mentioned sprays to prevent any further possible damage.

Codlin-moth.—In the colder districts of the Dominion spraying for codlin-moth is not considered necessary after the end of February, but this does not apply to many of the warmer districts. In such districts moth-affection is likely to occur right on to the end of March. Where such conditions obtain it is obvious that the spraying should be continued until all danger is past. Particularly in such districts should the greatest attention be paid to the length of time allowed between the last spraying and the gathering of the fruit, for herein, as explained in last month's notes, lies a great and not generally recognized danger of moth-infection.

CULTIVATION.

In a great many cases the cultivation of the orchard is from now onward more or less neglected. This is a mistake. The trees still require moisture to properly mature their crops and for the development of their fruit-buds for next season. Weeds also require moisture in their growth: this they take from the soil, and consequently rob the tree to an equal extent, without fully compensating for the damage done when ploughed in later as green manure. Surface cultivation will prevent this leakage by destroying or by preventing the weeds from growing, besides conserving the maximum amount of moisture already in the soil. An orchard should be either kept clean and well cultivated, or be systematically sown down in a cover-crop which, when subsequently ploughed in, will return to the soil the maximum amount of beneficial matter.

Cover-crops require to have a good start in order to be grown well during the autumn. February or March is the best time

for sowing such crops. Almost invariably useful rain falls during
to earlie. The crop should be sown just prior to or immediately
number of cases w rains; it will then have a good chance of coming
check such diseases being sufficiently forward for ploughing in before
leech. mustard, vetches, field peas, beans, &c., are
Powdery Mildew.—for this purpose. Mustard is not a legume,
perly attended to this provides a plentiful supply of humus.
to cause any particul er-crops, particularly such crops as mustard,
still be found ample af to sow lime also for the purpose of counter-
more susceptible varieties, d by the decaying green crop after being
than is desired before the

EXPORT.

The first export shipment of fruit for the season will probably leave the Dominion during March. Although our export trade in fruit is so far not large, the heavy planting of fruit-trees in several of the fruit districts during the past few years has been such that a correspondingly rapid growth must soon take place in our export shipments. To fully prepare for the time when this stage of our fruit industry is reached, it is imperative that we should take the fullest advantage of our present opportunities by organizing what is now a comparatively small business, thus fitting ourselves to cope with a much larger future trade, with satisfaction to the growers and the markets they supply, and with credit to the Dominion. *We must recognize that we are new to the business of supplying* markets other than our own, and comparatively unfamiliar with the different conditions entailed in the selection, packing, and otherwise preparing of shipments of fruit which have to be carried thousands of miles prior to being exposed for sale before people who have had many years of trade with the leading fruit-exporting countries of the world. Up to the present we cannot claim, in face of the criticisms received from South America last year, to have given that full satisfaction which is essential to the welfare of a new and rapidly extending industry.

It is quite evident that objectionable features of the past must be eliminated in the future if we are to retain our present trade with South America, which we sincerely hope is only the foundation upon which to build a much larger trade. With this object in view, conditions governing the export of fruit for the coming season (as published elsewhere in this issue) have been drawn up and submitted to all exporters of fruit. Under these conditions, and with the co-operation of packers and exporters, New Zealand fruit should soon redeem its name on the markets of South America.

THE POULTRY-RUN.

F. C. BROWN, Chief Poultry Instructor.

CULLING.

A MATTER that should specially concern every poultry-keeper at the present time is the culling-out of every bird that is not paying or likely to pay its way. With the high cost of foodstuffs, no sentiment can be allowed to enter in this matter. It is essential that every layer that is finishing its second season of production (with the exception of any noted breeders) should be got rid of in the

very near future. Indeed, under existing conditions, drastic culling should take place in the majority of flocks after the pullet's first laying season. In these times of dear cost of production it is only the very best laying bird that will show a fair margin of profit during its second laying season. It should be remembered that, generally speaking, the second-year layer will take a rest for several months during the dear egg season before commencing to lay again. Considering that most of her eggs are produced in the cheap season, it is obvious that every inferior and even medium bird retained in the flock reduces the profit of the money-making pullets.

While culling of undesirable stock is the keynote of successful poultry-keeping, this operation is probably the most difficult of any connected with the business to teach the novice to do properly by printed matter. The best guide, however, in this important work is to look to the moulting stage as a sign by which the good layers may be distinguished from the drones. The birds that should be culled are those that are moulting or showing signs of it, those above the normal weight of their breed, those with poor development in the abdominal region, and those of weak constitution, dull eye, loose feathering, and a sluggish appearance. It would be a mistake to cull birds at any time that show indications that they are laying, such as no sign of moulting, red combs, a fullness in the abdomen, and an active businesslike appearance.

Although the width of the pelvic bones as a guide to laying-power is of no value, it is, however, a fact that the position of these bones is a fair guide as to whether the bird will lay in the near future or whether she is taking the usual rest before moulting. If the bones are close together and the breast-bone close up to them it may be taken for granted that the bird will not lay for some time, and therefore will be unprofitable to keep. If the pelvic bones are wide apart, and there is a good depth between these and the breast-bone, a fullness of the abdomen, combined with fine skin-texture, it may be safely reckoned that the bird is laying or will soon commence to do so, and is therefore well worth retaining in the flock until she shows signs of moulting. Of course, the person with a trained eye does not require to handle the bird at any time to know whether she is in a laying condition or not.

THE SURPLUS COCKERELS.

As to the surplus cockerels, any of these that are from four to four and a half months old should be marketed at once. One of the greatest mistakes made in poultry-keeping is to hold on to a cockerel with the hope of making more money out of it. It

should be remembered that once a bird passes the chicken stage it costs much more to feed and grows less in value every day. Once a bird is nearing a mature age—at which it is known to the poulterer as a stag—it is considered to be only of the same value as a cull hen, and he pays a price accordingly. A case in point recently came under my notice at a poultry saleyard at Christchurch. A line of cockerels about seven months old and weighing fully 5 lb. each were offered, and realized 4s. 4d. a pair. In the next pen were birds about four and a half months old, and which would not turn the scale at more than $3\frac{1}{2}$ lb.; these brought 7s. 8d. a pair. Of course, the latter, although young, were in prime condition, as all birds sent to market should be. It is quality and not quantity alone that the high-class poulterer demands, and it is impossible to cater properly for this trade unless the bird is marketed at the right age, and fed and managed to the best advantage.

SELECTING THE BREEDING-HEN.

No time should be lost now in selecting the most desirable hens to breed from next season. While it is generally recognized that breeding from the best layer generation after generation is a sound policy, the fact cannot be emphasized too strongly that the best layer is not necessarily the best breeder. It may be true that one character can only be improved at the expense of another. There is, however, a medium to all things, and if everything is sacrificed for egg-yielding power, then something must suffer. Where the chief danger lies in making egg-yielding power the sole objective—a condition which is becoming far too common—is the weakening of constitution, reduced size of the stock and the eggs they lay, their susceptibility to disease, as well as proneness to ovarian troubles, and the difficulty experienced in rearing the chickens. The good layers should certainly be selected to breed from, but it is imperative that size, type, and constitution should be considered as well, while, of course, breed-points should never be forgotten.

There are exceptions to every rule, and it is not uncommon to find an undersized, racy-looking bird, with no special type, a heavy producer and a late moulter; but this is not to say it is a desirable breeder. The weaknesses referred to will never be corrected if such specimens are bred from; on the contrary, they will be encouraged. In breeding the general tendency is to lose in weight of stock. It is, therefore, imperative, if size is to be maintained, to choose for the breeding-pen the hen of a larger size than that of the ideal laying weight. Even when this principle is practised small ones will always come to vex the breeder. It should never be forgotten that it is a simple matter to reduce the size of stock, but once it

runs down it is very difficult to increase it without introducing coarseness.

It is generally considered—and rightly, too,—that the late moulter is the correct bird to breed from, provided it possesses the desired size, type, and constitution. On no account should the selection of the breeding-hens be left till the flock has moulted, for it is next to impossible to accurately judge the value of any character in a bird when it is undergoing the moulting process. Again, even when a flock has moulted and the birds have their full plumage the late moulter cannot be detected from the bird that moulted early. All breeders should be selected at once, and marked with leg-bands. They should be placed by themselves and everything done to retard egg-production, such as by supplying a plain diet or a change of diet and a change of quarters. This will give the birds an opportunity to recuperate before being called upon to produce eggs for reproductive purposes. If every available egg is forced out of them they have not the power to impart to their offspring the necessary vitality that heavy egg-production demands. While recommending that the birds intended for breeding purposes be given a rest, it is not to be inferred that this applies to the ordinary laying flock. These should be forced for egg-production until the season is completed.

To sum up, an ideal breeding-hen should conform as nearly as possible to the following: She must be healthy; head short and broad, with prominent eyes, a clean face free from wrinkles; be tightly feathered; have an oblong body on legs of medium thickness (shank being short and bone flat) set wide apart; well-developed crop; deep and full abdomen (which should be soft to the touch) and wide across the saddle—a wedge-shaped appearance being thus presented from either the top or side view-points; the bird should also present an alert and vigorous appearance.

THINGS TO REMEMBER.

It is not uncommon to find the late moulter laying up to April and even May, and very often they commence laying again before the early moulters.

When meat is not available milk is a good substitute.

It is the pullet that must be depended upon to produce the winter egg.

An early-moulting hen would have no chance of winning an egg-laying competition.

Once breed-points are lost sight of, purebred fowls will soon revert back to mongrels, and the egg-yield will in consequence be affected.

THE APIARY.

F. A. JACOBSEN, Apiary Instructor.

THE present is a period when little advice can be given that has not been mentioned before, and the main thing is to provide ample room for colonies storing honey. I have already this season come across two beekeepers in a fair way of business who have lost a considerable portion of the season's crop through lack of accommodation. A super with frames and foundation costs about 5s., and when filled with honey it is approximately worth £1; hence negligence on these lines is a losing proposition.

Extracting will be the order of the day during the next few weeks. Owing to dry weather, Canterbury and North Otago, unfortunately, cannot expect much of a honey crop. On the other hand, Southland is expected to excel all previous production. The other districts of the Dominion will have to be satisfied with an average return. Canterbury has suffered for the past three seasons, while the other provinces have been treated in a more liberal manner; but it is to be hoped that next season's crop will be a liberal one—equal to that of 1909, when one apiary of 110 colonies produced 18,500 lb. of honey. May every apiary in Canterbury equal this result next season.

The writer has been in the southern Wairarapa lately, and extracting had already commenced there, although it was not in full swing. This part would be a wonderful district if it were not for the thick unextractable honey gathered during the spring, which necessitates double work for the beekeeper. The practice is to hold all thick honey for winter use. The strongest colonies I have ever seen are located here, and in one apiary 5 lb. of bees were taken from each hive in November without impairing the working-ability of the colonies in the least. If there is much honey to get, these colonies will certainly manage to secure it. The swarming trouble militates against the success of a commercial apiary in such localities; but the difficulty is overcome to a large extent by the most ingenious method of placing a new hive on the old stand with a queen-cell, and thus capturing all the flying bees, and turning the old hive with its back to the new one. When the flow is in full swing the old queen is killed and the two colonies united.

It seems ridiculous at this period to write of bees starving, yet unfortunately that is what is actually happening in certain localities, where the bees are living from day to day. Care should be taken by the beekeeper not to suffer loss in this respect.

If the produce of bees is his sole living, my advice is to look after them and supply nourishment; they will certainly reward him at some future date.

Those beekeepers who are anxious to control foul-brood more effectively in their own districts now have an excellent opportunity of doing so through becoming local inspectors, as provided by the Apiaries Amendment Act. A number have already taken advantage of this offer, and others who wish to be on the same footing should communicate with the Director of the Horticulture Division. A very large number of beekeepers have from time to time expressed their appreciation of the assistance rendered them by the Apiary Instructors in the control of disease, but at the same time have fully recognized the difficulties these officers have to contend against through having the control of such large districts. The appointment of local inspectors does not mean that the disease has not been controlled, but rather that through an insufficient staff it has not been controlled fast enough.

THE FARM GARDEN.

W. H. TAYLOR, Manager, Arataki Horticultural Station.

VEGETABLE-CULTURE.

SUCCESS in vegetable-culture can only be obtained by sowing or planting at the proper time. In many cases no after-care can compensate for sowing at the wrong time, or putting out improper plants. Conditions prevailing in different districts have some effect, but the fundamental principle remains the same. The difference will be merely a matter of dates. It is, for instance, always bad practice to put out cauliflower-plants that have been a long time in the seed-bed. This is the more marked in the case of early varieties, which are precocious in their habit of early buttoning. An attempt to get ahead of the season often ends in failure. Some think in this way: If by sowing cauliflower-seed at the end of March I can get cauliflowers early in November, why not sow early in March and get them in October? The reason why not is perfectly plain to those who have experience. It is only safe to sow when the influence of summer weather has gone. Cool conditions enable the plants to make growth before buttoning. The way to help the plants to a good development is to prick them off into a rich piece of ground, as soon as they can be handled, so as to encourage rapid growth. This is one of the necessary steps to secure good early cauliflowers. The later sorts are not

precocious in buttoning, and succeed without the pricking-out step, but are better with it. These varieties are apt to become precocious if plants that have been long in the seed-bed are planted.

The actual commencement of spring varies in different parts. Because local conditions vary so much, a scheduled date must be wrong in some places. Still, as said before, the difference is in date, not principle. Spring-time possesses an exciting influence on vegetation. There is a general awakening, a rush of growth. This influence will affect the most excitable functions of a plant. Celery, carrots, turnips, parsnips, &c., all rush off to seed. Why? Because it is natural, and the law cannot be evaded. It is safe to sow carrots in July with a certainty that they will properly develop and go to seed in a little more than a year. Sow carrots in May, or even in June in some places, and they bolt to seed at latest by midsummer. It is advisable on occasion to sow early—say, in April or May; but only a small lot should be put in: they never stand through the next season. My experience has been that turnips sown in July nearly always go straight to flower without bulbing; but it is safe to sow in August. Many failures that are attributed to bad weather or a bad strain of seed are due to such causes as above mentioned.

Current Work.—Cabbages, broccoli, savoys, and *Brussels sprouts* should all be planted early in the month. In the colder parts of the Dominion the winter supply of turnips should be provided for by sowing early in March. In the North Island the end of March or early in April is time enough. In such places it may be advisable to make another small sowing to last till the winter crops come in.

Spinach for the winter supply should be sown during February in all but the warmest places, where mid-March will be early enough. During summer spinach is a very temporary crop: it quickly runs to seed. The usual plan in domestic gardens is to sow between rows of other vegetables. For the winter supply it must have a bed to itself, for if properly treated it will stand the whole winter, and prove the most profitable crop in the garden. Sow in rows at least 12 in. apart, and thin the plants to about 9 in. apart. Plants allowed this space will more than meet each other: they will overlap, and afford frequent gatherings of large leaves. It is important to use the leaves as they become fit, as it encourages the growth of others and keeps up the supply.

Silver and *spinach beet* may still be sown. The plants should be thinned to 12 in. apart. These beets transplant very well. *Celery* requiring moulding up should have the operation carefully performed. The soil should be pressed very firmly around the

lower parts of the head, otherwise the weight of soil may cause the stems to bulge out, which is liable to render the heads pithy, and consequently very inferior. Harvest *shallots* and *garlic*. *Onions* should be well dried before they are stored. In very hot places they dry best under partial shade, such as the floor of an open shed. It is injurious to the bulbs to leave them lying in full sunshine where it is very hot. Keep the soil loose between rows of all young plants.

SMALL-FRUITS.

Bush fruits of all sorts give good crops only when the buds are properly developed. No amount of winter pruning or manuring will cause the production of good fruit unless the buds have been properly built up. Plenty of light is one necessary condition. If the bushes are crowded good work will be done by thinning them out at once. The number of branches should be limited, so as to enable gathering to be done with ease. This is a good time to mulch around the bushes with stable or farmyard manure. Rain will wash it in, and the buds will benefit. It will be in a good state to dig in later on. Artificial manure should not be given at this time.

Cut out dead canes from *raspberries*. This work is better done early, because it gives more room for next season's fruiting-canes to finish growth and ripen up. More depends on the proper growth and ripening of the canes than on any manure that may be given. Poor canes will not give good fruit. For similar reasons loganberries should be relieved of the old rods as soon as fruit is past.

Cape Gooseberries. — It is important to secure a good strain. There are some that are not worth growing. The best way is to save seed from the best; this is likely to be more satisfactory than purchasing. Seed should be sown in the autumn, the seedlings pricked off into boxes, and kept in shelter till danger from frost is past. It is a mistake to wait till spring before sowing. The resultant plants are not strong enough nor sufficiently hard in fibre to do well the first year.

THE FLOWER-GARDEN.

Roses.—Many questions are asked about these. Many of the pests, such as leaf-spot, mildew, and aphis, are to a large extent the result of sudden changes of weather. Plants that are frequently watered are subject to such conditions. They are best grown by what I term "solid cultivation." Trench your ground deeply, and work in a liberal quantity of manure of some kind.

Dig the ground early in spring, and keep the surface loose. Good roses will be produced with a minimum of trouble from pests, and without recourse to watering. This does not mean that watering is bad, but that frequent watering is bad, and is a poor substitute for properly prepared ground.

Carnation layers that are well rooted should be taken off. Plant them in nurse-beds of free soil, in an open situation. Carnations are quite hardy, and are children of light. They abhor shade. A snug corner is not a suitable place for them.

Seeds of hardy annuals may be sown in the open as soon as autumn rain has fallen. Some suitable species are — *Linaria*, *candytuft*, *Nigella*, *Chrysanthemum segetum*, *Virginian stock*, *Leptosiphon*, *Nemesia*, *Nemophila*, *Gillia*, and *Cosmidium*.

Sow under glass perennials of all kinds, including *Delphinium* and *Gypsophila paniculata*. This latter is not sufficiently grown; usually it is restricted to a single plant in a garden: it is worth more extensive cultivation. *Gypsophila* looks well in large groups; planted among *gaillardias* or *pentstemons* is just the use for it.

Continue to plant *narcissi* and other bulbs. It frequently happens that it is necessary to dig up clumps of bulbs owing to their having become crowded or for various other reasons. If bulbs are so lifted during the hot weather they should be taken away at once and put under cover, otherwise sunshine may quickly destroy them.

A RECENT VIEW OF THE HOMESTEAD, RUAKURA.

ANSWERS TO CORRESPONDENTS.

In every instance a question to which an answer is desired in these columns must be accompanied by the full name and the postal address of the inquirer, not necessarily for publication, but as a guarantee of good faith. The question should be written on one side of the paper only.

WARTS ON CALVES.

J. STORY, Manawaora, Russell :—

We have some four or five calves with warts on their necks ; one is warts from cheeks to dewlap on both sides, and so thick that they are one mass. How the calves developed them is a mystery to us. We have heard that castor-oil is good against warts, and change of pasture, also caustic soda and oil of cinnamon ; but should be glad of advice.

The Live-stock Division :—

It is not uncommon to have a lot of calves affected one year, and other years not to have any. In many instances the warts disappear in time without treatment, especially if the animals are given a change of pasture. The best treatment is undoubtedly removal with the knife. Evidently, however, in one case you would practically have to skin half the calf. The operation is painful, and chloroform would have to be given. For treatment, put about three handfuls of ordinary washing-soda into a gallon of hot water, and with a stiff brush scrub the warts and get them as clean as possible. When dry, dress the mass thoroughly with olive-oil, repeating the dressing each day. If possible, give the calves a change of pasture, and also a course of arsenic. Give each calf each day for ten days a tablespoonful of Fowler's solution of arsenic (dose for six-months-old calf) ; then leave off, and if they are no better at the end of three weeks you can give them another course. If the olive-oil does not succeed, you can then try castor-oil. The substance oil of cinnamon is much too expensive to be used in such cases, even if it had any value.

ACETYLENE REFUSE AS SOIL-DRESSING.

"AMATEUR," Birkenhead :—

Would you kindly let me know whether the refuse from an acetylene-gas generator would be of any use in a clay soil. If so, what would be the best way to apply it ?

The Fields Division :—

The refuse from an acetylene-gas generator is useful material for application to a clay soil, inasmuch as it is mainly composed of slaked lime, which, as you are no doubt aware, has a marked effect in improving the texture of clay soils. It should be broadcasted on the surface early in winter, preferably on grass land which has to be broken up. In the case of a good strong clay soil the application of 2 tons per acre would not be too much, but any lesser quantity would have a proportionate effect.

CROSS-FERTILIZING OF PLUM-TREES.

"INQUIRER," Albany :—

I have two varieties of plums growing near each other, both of which need cross-fertilizing. Unfortunately, one variety blooms much earlier than the others and so they do not get properly fertilized. If I spray the early variety with red

oil, will that make it bloom later? If not, can you tell me anything I can do to make it bloom a little later?

The Horticulture Division :—

A late and heavy application of oil will delay the blossoming of fruit-trees, but such treatment is risky. Early pruning invariably induces early blossoming. Combined, this treatment might even-up the blossoming period of your trees sufficiently. The most satisfactory method, no doubt, would be to work over some of your trees with varieties that bloom at the time required.

BUTTER FOR WINTER USE.

"W. N. C.," Omaio :—

Will you kindly let me know the best way to keep butter for winter use?

The Dairy Division :—

In order to ensure that butter will maintain its keeping-quality to a reasonable degree when held over for winter use it is necessary to take special care in the process of production, right from the milking of the cows up to the point when the butter is packed for storage. All vessels should be thoroughly washed before use, and scalded with boiling water. The cream should be cooled, and, where possible, churned at a temperature not higher than 54° F. If a well is available, the cream can be lowered in a closed vessel and thus reduced in temperature. The butter should be churned in the granular form, and all traces of buttermilk removed by washing with cold water. The salting should be a little heavier than in the case of butter for immediate use—say, according to taste, ¾ oz. to 1 oz. of salt to 1 lb. of butter. The addition of a little butter-preservative, not exceeding 35 grains per pound of butter, is an advantage. Butter keeps best when frozen, and therefore the coolest place in the dairy is recommended for storage.

"PEA" IN COW'S TEAT.

"SUBSCRIBER," Pembroke :—

Would you kindly inform me of the best treatment for a milking-cow's udder which has something at the top of the teats that moves about, and makes the cow very irritable, and keeps the udder very full-looking?

The Live-stock Division :—

The growth in the cow's udder is what is known as "pea" in the teat. It is usually a small fibrous tumour or thickening of the membrane. The only rational treatment is to cut down upon it when the cow is dry and remove it.

CONTROL OF CABBAGE PESTS.

"J. K.," Hastings :—

Will you please inform me what is a good spray for cabbage-fly?

The Horticulture Division :—

It is not clear if it is the cabbage-moth or the aphis that is referred to. The former is controlled by spraying with tar-water; the latter by the application of kerosene emulsion, or Sunlight soap, 1 cake dissolved in 3 gallons water. Spray well the under-sides of leaves.

FEEDING SMUTTY OATS.

N. WATSON, Waiheke, Auckland :—

I shall be obliged if you will inform me whether a certain amount of smut in oats will do any harm to cattle if the oats are cut and fed as chaff.

The Fields Division :—

Smutty oats are liable to result in digestive disturbance when fed to cattle, and cases are known where the results have been so marked as to amount to *actual poisoning*. *This happens when smut is present to a large extent*, and is aggravated if the condition of the fodder in other respects is poor. An ordinary amount of smut in an oat crop—say, not exceeding 5 per cent.—will not harm cattle.

GROWING FUNKIAS.

" A. H.," Waverley :—

Will you please tell me how to grow funkias? I want to grow them in pots for house decorations, and out of doors, to use the leaves for cut flowers for the house. When should I divide the roots ?

The Horticulture Division :—

Funkias are Japanese hardy herbaceous perennials of the easiest possible culture. The variety *variegata* is the best for pot work. Apply liquid manure *sparingly*. *The variety orata, with green leaves and blue flowers, is the best for* open-air culture. The leaves are large and the flower-spikes long. Plant in a dryish soil in a partially shaded position, such as beneath the overhanging branches of deciduous trees. Pot specimens can be divided at any time, open-air varieties when dormant in the winter.

GROWING CUTTINGS OF LAURELS, ETC.

" NEW CHUM," Pahiatua :—

I intend to grow cuttings of laurels, laurustinus, roses, &c. Will you please give me particulars as to how to grow them, and what time to put them in ? The soil that I intend to put them in is a fairly light humus soil, which is getting rather poor. Could you tell me what artificial manures is beneficial for them ?

The Horticulture Division :—

Cuttings of laurels, laurustinus, and roses can be taken any time during the dormant season—late autumn is usually the time preferred. Select wood of previous season's growth, taken with a heel where possible, or cut just below a joint formed by a bud. Disbud the cutting, leaving two or three leaves in the case of the laurustinus and laurel, and buds in the case of the rose. Place the cutting in a shady place in damp sand to callous, and plant in nursery rows in early spring. To improve your soil, dress it with lime and work in stable manure.

UNTHRIFTY CALVES WITH COUGH.

" DAIRYMAN," Norsewood :—

I have some calves which have been fed on whey and calf-meal. They are not doing too well, so I have weaned them, and notice some have a husky cough. I have been *told to give them hellebore* as a dose, but *would like* to know the best thing to stop the cough. They are on good feed, but do not seem to come on.

The Live-stock Division :—

We would not recommend you to give hellebore or any other drugs of a similar nature in such cases. It is preferable to give small doess of cod-liver oil. For this purpose the oil should be given mixed with a little warm milk in doses *of 2 oz., repeated twice daily*. *General care and attention to the conditions under* which the animals are kept and fed should not be neglected.

GREENGAGE-TREES.—SUNFLOWERS.

" INTERROGATION POINT," Clive, Hawke's Bay :—

1. I have an acre of land planted in ten-year-old greengages. Three years ago *they* yielded a good crop. Last year the frost ruined them in November. *This year they flowered abundantly, but afterwards withered off*, with no noticeable frost to account for it. The land is rich, dark soil, well sheltered, and about 2 miles from the sea. Can you explain their failure ?

2. In a recent issue of the *Journal* the cultivation of sunflowers for seed is recommended. Can you give me further particulars of them, market price per bushel, the best markets, best mode of threshing, suitable soil and situation for planting, &c.?

The Horticulture Division :—

1. Greengage-trees are notably slow in coming into regular bearing. Your trees may have blossomed too abundantly, resulting in weak pollen; frost or cold winds may have affected the blossoms. There is no special reason why greengage-trees grown in your orchard should not do satisfactorily.

2. Sunflowers, as will be seen by the article you refer to, require considerable quantities of potash; therefore they should be grown preferably on good rich soil. The Russian sunflower is the variety usually sown for commercial purposes. A market for fair quantities can be found among New Zealand seed-merchants at about £16 per ton. Small quantities, when thoroughly ripened, can be threshed by means of the old-fashioned flail, whilst larger quantities should be put through an ordinary threshing-machine.

BOTTLE-FED LAMBS SCOURING.

"INQUIRER," Glenorchy :—

Will you kindly give a remedy for bottle-fed lambs scouring?

The Live-stock Division :—

Keep your milk utensils and feeding-bottles scrupulously clean, boiling each, if possible, after use to kill any micro-organisms which might set up the condition of scouring. Also see that the lambs are fed at regular periods. Do not let them miss a meal and then give them double quantity next time to make up for it. If this is done the stomach is overloaded and digestion cannot be performed properly. The result is indigestion and nature's effort to relieve the condition—scouring.

TREES FOR RESERVOIR PROTECTION.

E. DUPLANTIER, Portland :—

Would you kindly let me know what trees would be best to plant round a water-reservoir for protection from sun and wind, so as to reduce evaporation to a minimum?

The Horticulture Division :—

We should, for such a purpose, advise the planting of weeping-willows. Such trees grow fast, and, although they would utilize a fair quantity of water in their growth, would provide an excellent shade and wind-break.

MACROCARPA FOR POSTS.

T. C. GOUDIE, Cabbage Bay, Coromandel :—

I have a number of large macrocarpa-trees (evergreens). Please let me know if they are any good for posts.

The Horticulture Division :—

When available, macrocarpa is commonly used for fencing-posts and for similar purposes. It lasts in the ground very satisfactorily without any special treatment. See article "Forest-trees for Settlers," by Tasman Smith, in the *Journal* for August, 1915, in which (page 108) the author's experience with macrocarpa posts is given.

As a result of the investigations carried out on the inheritance of fecundity in poultry, the system of so-called mass-selection, or indiscriminate breeding from all fowls having a high egg-production, has been abandoned at the Maine Experiment Station. During the last two or three seasons another system, on Mendelian lines, has been introduced in its place—viz., the organized mating of selected strains of fowls whose gametic composition has been previously determined. Though the change of method is so recent, there is already a marked increase in the average egg-production as compared with the numbers obtained when simple mass-selection was practised; moreover, the increase is most pronounced during the winter season, a factor to which special attention was paid in the breeding.

AGRICULTURE ABROAD.

APPEAL TO ENGLISH FARMERS.

THE following appeal, made recently by the President of the English Board of Agriculture (Lord Selborne) to farmers and occupiers of land in England and Wales, will be read with interest by men on the land in this Dominion :—

"As Minister of Agriculture in this present time of war, I desire to appeal to you who live by the land to assist your King and country by producing as much food as possible on your holdings in the coming year. It is always a wise precaution for a nation at war to provide as much food as it can within its own borders. You must remember that this war has to be fought with money as well as men, and every additional pound's worth of food which you can grow means a reduction in the quantity to be purchased from abroad, and is therefore a direct contribution to victory.

"The chief needs of the nation are more wneat, meat, milk, oats, potatoes, bacon, and cheese. I cannot hold out any hope of a special financial inducement from the State; on the other hand, I do not ask you to do anything which would diminish the capital necessary to enable you to farm well; but, subject to this reservation, I ask you to do your part in producing larger quantities of the commodities mentioned above as the special war service which you can render to your country. I invite also all market-gardeners, cottagers, and allotment-holders to do their share by increasing the production of vegetables, pigs, and poultry, and by living on the produce from their gardens and allotments as far as possible. By this means they will save money for themselves and increase the amount of food available for others.

"The conditions of farming vary so much in the different localities that I cannot attempt to make any general recommendation for your guidance as to the means you should adopt for increasing the production of food on your holding. That must be left to your judgment and to the advice of your friends and neighbours. But I suggest that you should consider whether you cannot attain the object in view by one or more of the following methods :—

"(a.) By ploughing up those of your poorest permanent-grass fields which are suitable for conversion, and so increasing your arable land :

"(b.) By shortening the period for which your existing arable land is kept under clover or rotation grasses :

"(c.) By improving your remaining grass land so that it will carry more stock :

"(d.) By reducing your acreage of bare fallow wherever possible.

"I realize that increased production cannot be obtained without a great effort, and that farmers have to face many special difficulties in these times. It is my desire to help you to overcome these difficulties by all the means in my power.

"The chief one which now confronts you is that of labour, and in this connection I have arranged with Lord Kitchener that, as soon as the analysis of the National Register has been completed, men of the classes of working farm bailiffs, shepherds, stockmen (including milkers), horsemen, thatchers, engine-drivers, and mechanics and attendants on agricultural machinery, steam ploughs, and threshing-machines will not be accepted for enlistment, even if they should offer themselves.

"This valuable concession will enable you to retain the services of your skilled workers, upon whom I desire to impress that they are serving their country best by remaining at their accustomed occupations. But the difficulty will still remain in respect of the supply of ordinary farm labour. The staff of the Board of Agriculture are ready to assist you as far as possible, but they cannot cover the whole country, and in order to help you in respect of the supply of labour and of any other difficulties which may arise I have asked the County Councils to assist the Board of Agriculture, and they have willingly agreed to do so. Steps are being taken for the appointment in each county of a War Agricultural Com-

mittee, representative of all the agricultural interests of the county, and for the appointment of local committees in each district. I ask you to consult these local committees on any problems and difficulties which may confront you. They will consist of your neighbours and friends who know the local conditions, and in many cases they will be able to assist and advise you. If they cannot do so, they will refer to the County Committee, which will have at its disposal the services of the county staff for agricultural instruction and of the experts connected with the Provincial Councils for Agricultural Education, and which will be in touch with all the available sources of the supply of labour. The County Committee will be assisted by a representative of the Board of Agriculture, and will report any special difficulties to the Board

"By means of this machinery it will be possible for me, as Minister of Agriculture, to be kept informed of the needs of farmers throughout the country, and to secure that all the help that can be given to you is placed at your disposal.

"I ask you for your part to devote all your energies to the task that is set before you, and I am confident that I shall not ask in vain."

CO-OPERATION AMONG FRUITGROWERS IN CANADA.

THE following is an extract from an interesting account of rural co-operative enterprise in Canada received by Mr. Edwin Hall from Professor H. Mitchell, of Queen's University, Kingston, Ontario:—

A good deal of success, mingled with many failures, has attended the efforts of growers to put their fruit on the market through a system of co-operative organization. Twenty years ago the fruitgrowers both in Ontario and Nova Scotia were absolutely in the hands of the English buyers; prices were beaten down so low that many farmers gave up their orchards, and the whole industry was in a thoroughly bad way, at the mercy of the wholesale houses.

Since then Nova Scoita has transformed conditions, and the growers are strongly organized in a number of small associations, which in turn are members of a large one—the United Fruit Company of Nova Scotia. In Ontario also there are nearly sixty fruitgrowers' co-operative associations, and twenty-five in British Columbia, and the whole fruit industry has been transformed: put on a satisfactory basis both for grower and consumer, and made one of Canada's most lucrative industries. The apples or other fruits are delivered by the farmers to the warehouse of the association, always situated on a railway-siding for easy shipment, where they are graded and packed by experts. The manager secures a market for the fruit in wholesale quantities, and each member is credited with his share of the proceeds. In addition to this, farm necessaries are bought wholesale and distributed among the associates. In this way large sums are saved on the purchase of manure, barrels, packages, spraying-machines, chemicals, &c. The dishonest grower, who put rotten apples beneath a top layer of good ones, is being ruthlessly eliminated, the whole status of the fruit industry has been greatly improved, and new markets have been opened up. The co-operative movement among fruitgrowers is, in fact, a most encouraging one, and there is no reason to suppose that it will not endure, and continue to increase and prosper.

FRUIT-BREEDING WORK IN MINNESOTA.

THE first State fruit-breeding farm in Minnesota was founded about six years ago, on the shores of Lake Minnetonka, under the management of Mr. Charles Haralson. He has already accomplished some important work and given the institution considerable development, as it is already producing some 70,000 seedlings annually; and its area, at present 80 acres, will soon be increased by 40 or 50 acres more.

The apple is the most important fruit in Minnesota, and it has received the most attention from the breeder, with the object of obtaining by crossing and selection a hardy tree that will bear the most delicious fruit capable of keeping sound for a long time. With this object, the hardy Malinda, the fruits of which

have long-keeping qualities, has been crossed with the Wealthy, Rome Beauty, Delicious, and other standard apples. There are now more than 10,000 seedling apples on the farm, aged between four and seven years, thus obtained, and some 500 of them have already commenced to bear, and the apples are of good quality.

Thousands of seedlings of the De Soto, Wolf, Atkin, and other native plums have been planted, and, out of these, 315 young trees that are superior to their parents in size and productiveness have been selected. Much superior results have been obtained by the crossing of the native varieties with the large Japan plums, and especially by the cross between the Wolf (native) and the Burbank (Japanese). No. 21 is an early seedling that has attracted considerable attention for its hardiness and earliness (it begins to bear at the age of two years), as well as for its abundant and regular yield, the size of its fruit (about 1¾ in. in diameter), its colour, and the fact that it is a free-stone with a very small pit. The best seedlings are being propagated, and sent to the trial stations for further testing. They will not be distributed among the public until the list has been narrowed down to three or four of the best, of known superiority to any of the varieties now cultivated.

Another important work of selection was the improvement of the Beta grape, which is a hybrid of the wild with some unknown standard grape. It is exceedingly vigorous and hardy and resistant to cold, but its fruit is somewhat too acid. Mr. Haralson has crossed Beta mostly with Concord and Brighton, and he has selected 5,000 seedlings out of 15,000. At least one-third of the selected vines bears fruit of larger size and better flavour than the Beta, and still retains its vigour and hardiness.

From the famous Senator Dunlap strawberry Mr. Haralson has virtually evolved a new type, more vigorous than its parent; it bears its fruit on much heavier upright stems, and still retains the quality and productiveness of the Senator. Out of 60,000 seedlings he has selected 800.

Five acres of the farm are covered with seedling raspberries. One variety, a cross between the King and London, seems to be the most desirable seedling. It has been sent to the trial stations, and the reports are uniformly good.

Crossing the Carrie gooseberry (a Lake Minnetonka production, that has proved to be the best gooseberry for Minnesota) with the best American and English varieties, Mr. Haralson has raised 5,000 seedlings, of considerable merit; one-third of these surpasses the parents in size and productiveness.

With the pear, the apricot, and other fruits usually considered too tender to grow in Minnesota attempts have been made to obtain hardier varieties. Breeding of a hardy pear has encountered many difficulties. Only about two seedlings out of a thousand have been free from blight, and most of them suffered from the frost. Nevertheless, the work has been continued, the hardiest commercial varieties being used as parents.

More success has attended the breeding of the apricot. Several hybrids of the plumcot—a cross between the plum and the apricot—have been crossed with native plums, and the results of this cross have been hybridized again with the apricot and the nectarine. The results have been highly satisfactory. Most of the seedlings have proved perfectly hardy, and are bearing fruit of various types, some closely resembling the apricot.

The Minnetonka Lake Station attends also to the improvement of ornamental shrubs. The most important result in this direction has been a hardy purple-leaf plum obtained by hybridizing the hardy native plum and the sand cherry with *Prunus prissiardii*. There are 500 of these seedlings, 75 per cent. retaining the striking foliage of their purple-leaved parent, and some have proved perfectly hardy, and bear choice plums of good quality.

Another handsome plant with ornamental foliage—namely, golden yellow streaked with light green—has been obtained by spontaneous bud variation in a hedge of alpine currant.

Rosa rugosa and *R. arkansana*, the native wild rose, have been crossed extensively with the hybrid teas and perpetuals, and several valuable hardy roses have been obtained.

The native hazel-nut has been crossed with the filbert, with the object of securing the hardiness of the one with the quality of the other.

Most of the hand-pollinating is done in the greenhouse. Mr. Haralson finds that the work can be done there five times as fast as it can in the open. Besides, much of it is accomplished in the winter, when the work is not so pressing. The

trees and shrubs that are to be treated are transplanted to the greenhouse in the autumn. The seed resulting from the hybridization is carefully planted in the open in the seed-beds, and the seedlings are transplanted to the fields. All the unsatisfactory specimens are discarded before they reach the fields. The process of grading is continued, and as fast as possible the number of seedlings is reduced. As soon as a seedling shows indications of being worthy of introduction it is propagated, and specimens are sent to the trial stations. Reports of the behaviour of the seedlings under different conditions are received and tabulated. If they give promise of general value under various environments the testing is continued, and when it is certain that a seedling has proved superior to any varieties already introduced it is distributed among the public.—WILCOX R. SELDEN, in *The Country Gentleman.*

RADIUM-TREATED SOIL AND PLANT-GROWTH.

THE radio-active material used in the experiments here summarized was obtained from the Standard Chemical Company of Pittsburg, Penn., and consisted of the finely powdered residue remaining from the radium ore after extraction and containing from 2 to 3 milligrams of radium per ton.

The first experiment was made on radishes growing in a window-box. The powder was applied at the rate of 16 grains per square foot between two rows of radishes 4 in. apart. The treated radishes soon appeared much inferior to the untreated, and, on weighing, the green tops of the former weighed 17 per cent. less than those of the latter, whilst the roots weighed about 20 per cent. more. Thus it appears that under the influence of radium it required less green-leaf surface for assimilation.

These boxes were then sown with cabbage and tomato seed, and germination took place one or two days earlier in the radium treated soil.

A series of experiments were conducted in a garden of 1½ acres with turnips, carrots, tomatoes, water-melons, celery, onions, peas, grasses, &c. The radio-active earth was mixed with a chemical fertilizer, which was the same in all cases. Every operation of seeding, hoeing, cultivating, &c., was performed across all five plots at once. The radio-active mixture was sown equally over the surface and dug in, except in one case where it was applied in the rows for comparison. The quantity of mixture applied varied from 25 lb. to 200 lb. per acre.

Nearly all the field crops gave an increased yield under the influence of the radium, the largest gain being 129 per cent. The optimum amount of the mixture varied with the different crops, and families of plants showed the same varying susceptibility.

The first effect of the radium is to increase root-growth, whilst the stem may be retarded for a time and later undergo a great acceleration of growth. The edible properties of the products were improved—*e.g.*, potatoes became more mealy, roots more tender and of finer flavour. Tomatoes were sweeter, and chemical analysis showed them to contain less water and more sugar.

In the case of turnips a much greater increase in weight of the roots occurred in the case of the long-rooted "cowhorn" variety than with the globe variety. Thus the larger the amount of root surface exposed to the soil the greater the effect of the radium. The root is more liable to become radio-active owing to the absorption of radio-active water, which exerts a continuously stimulating action on the root-cells.

The resistance to fungus diseases was not always affected in the same manner by the radium. Cucumbers and squashes were rendered more susceptible, whilst melons, tomatoes, and egg-plants become more resistant.

The beneficial effects of radium applications continue over successive crops, and the largest amount required by any crop would cost less than the increased market value of such crop of the first year. Its use does not decrease the necessity for fertilizing the soil, except in the case of virgin soils where ample reserves of plant-food exist.—H. H. RUSBY, Columbia University, in *Journal of the New York Botanical Garden.*

COMMERCIAL INTELLIGENCE.

THE WOOL MARKET.

CABLING on the 18th January, the High Commissioner reported as follows on the opening of the current series of wool-sales in London :—

"The wool-sales commenced with great competition for all wools, especially crossbred. The supply of New Zealand new clip is very small, and there was not sufficient offered to-day to test the market. Values are 1d. higher than the closing rates at the last sales. An upward movement is very likely to continue. Seventeen thousand eight hundred bales of New Zealand wool are catalogued."

On the 5th February the High Commissioner cabled as under :—

"The wool-sales closed strong. The market is booming on account of small supplies and manufacturers being busy on Government contracts. Only a small quantity of New Zealand new clip has been offered. Future prospects are good. Estimated closing values are as follows : Fine crossbreds, 1s. 8d. to 1s. 11d. ; medium crossbreds, 1s. 7d. to 1s. 9½d. ; coarse crossbreds, 1s. 6d. to 1s. 8½d. ; superior merinos, 1s. 7d. to 1s. 10d. ; medium merinos, 1s. 5d. to 1s. 7d. ; inferior merinos, 1s. 2d. to 1s. 4d."

FRUIT-EXPORT CONDITIONS.

The following circular memorandum, addressed to all exporters of fruit, was issued by the Director of the Horticulture Division, under date 18th January, 1916 :—

Shippers of fruit are reminded of the announcement made at the last conference of the New Zealand Fruitgrowers' Federation that in future all fruit intended for export must be forwarded to the shipping-ports for Government inspection before a certificate would be issued.

It was pointed out that it was quite impossible to continue examinations at the orchards or packing-sheds, it having been discovered that owing either to dishonesty or carelessness fruit which should never have been allowed to leave the orchard was substituted for some of that which the Inspector had passed. Complaints and threats received from South America in consequence were of such a nature as to show that the good name of New Zealand was jeopardized, and a very promising business being brought to the verge of extinction—a very serious condition of affairs, which can only be averted by more drastic measures being taken at this end.

Unfortunately the unsettled state of the Legislature of the Dominion due to the war has been such that it has been impossible to have gazetted definite compulsory export regulations so urgently required. Such regulations will, no doubt, be available for next season. In the meantime the following conditions, which are drawn up as far as possible on the lines of the proposed regulations, will apply to the export of fruit for the coming season. Such conditions are imperative, and are introduced for the purpose of obviating, as far as possible, the mistakes of the past.

1. All fruit must be forwarded to one or other of the following ports for examination prior to shipment, viz. : Auckland, Wellington, Motueka.

2. All fruit must be assembled at a shed set aside by the Harbour Board for the purpose of fruit-inspection at either of the above-mentioned ports at least forty-eight hours prior to the advertised sailing-time of the ship by which the fruit is consigned.

3. All fruit forming part of any wagon-load, railway-truck, or other consignment forwarded for inspection must be described as indicated by the following specimen form :—

Class of Fruit.	Variety.	Brand or Mark.	Number of Cases.	Size.
				Inches.
Apples	Cox	TBZ	200	3
,, ...	,, ...	,,	100	2¼
,, ...	,, ...	,,	50	2¾
,, ...	Jonathan ..	,,	100	2¾
,, ...	,, ..	,,	50	2½
Pears	Winter Cole ..	,,	100	2½
,, ...	Bosc	,,	100	2¾

A copy of such description to be delivered to the Government Inspector prior to the examination of the fruit. Blank forms for this purpose can be obtained on application to the local Orchard Instructors.

4. All fruit passed by the Inspector will be branded with a Government brand on the case, indicating that it has been approved for export.

5. All fruit for export must be evenly graded for size and properly packed. A variation of a quarter of an inch will be allowed between the different grades, but all variations in size must be above that indicated on the case, but must not exceed the minimum of the next grade. If any fruit is found below the size indicated, the line will be refused a certificate.

6. All fruit must be clean, sound, and free of disease, and must, in the opinion of the Inspector, be in all other respects in a fit condition for export.

7. Each box must be branded " New Zealand apples " or " pears," as the case may be. The mark of the shipper, variety, and size of fruit must also be clearly marked on the same end of the box.

8. No certificate will be issued covering fruit for export unless the foregoing conditions have been complied with.

9. The Department will undertake the inspection of all fruit free of charge, but the Harbour Board authorities will debit the consignor with the cost of all labour required in connection with the inspection, such as opening, closing, and branding cases, &c.

Although no further inspection will be carried out at the various orchards and packing-houses, the local Instructors will, as in the past, render what advice and assistance their time will allow prior to inspection.

In conclusion, it must be clearly understood that no certificate will be issued or case branded unless the above conditions are fully complied with.

FORTHCOMING AGRICULTURAL SHOWS.

Opotiki A. and P. Association : Show at Opotiki, 2nd March.

Oruru A. and H. Society : Annual Show at Oruru, 3rd March.

Hawke's Bay A. and P. Society : Autumn Show at Hastings, 7th and 8th March.

Rodney Agricultural Society : Annual Show at Warkworth, 11th March.

Ashburton A. and P. Association : Annual Show at Ashburton, 15th and 16th March.

Kaikoura A. and P. Association : Annual Show at Kaikoura, 17th March.

Amuri A. and P. Association : Annual Show at Waiau, 21st March.

Temuka and Geraldine A. and P. Society · Show at Temuka, 30th March.

Oxford A and P Association : Annual Show at Oxford, 6th April.

Mackenzie County A. and P. Society : Annual Show at Fairlie, 24th April.

Waikato Winter Show Association : Show at Hamilton, 30th May to 3rd June.

Manawatu and West Coast A. and P. Association : Winter Show at Palmerston North, 20th to 23rd June.

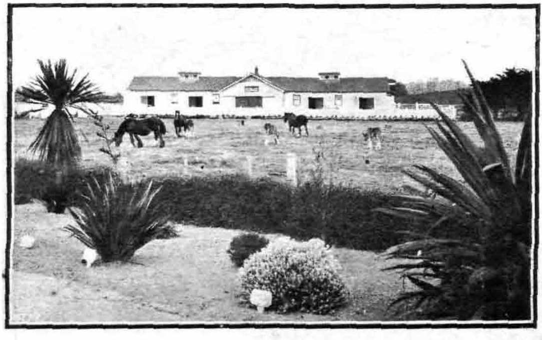
ESTIMATED YIELDS OF WHEAT AND OATS.

Estimated average yields of wheat and oats in the Dominion for the current season have been issued by the Government Statistician, based on reports of Fields Inspectors of the Department of Agriculture, as follows :—

District.	Bushels per Acre. Wheat.	Oats.
Auckland	25·55	24·95
Taranaki	30·67	43·61
Hawke's Bay	26·88	46·49
Wellington	32·34	37·92
Marlborough	23·83	35·50
Nelson	20·05	22·01
Canterbury	20·54	24·83
Otago	24·44	34·21
Southland	38·00	50·00
Average (estimated) for the Dominion, season 1915–16 ..	21·89	33·46
Average (actual) for the Dominion, season 1914–15	28·94	39·77

The Statistician adds that according to the above estimates the total yields for the Dominion should be approximately as under, the figures for previous year being given for comparison :—

	1915–16. Estimated Yield. Bushels.	1914–15. Actual Yield. Bushels.
Wheat	7,309,020	6,644,336
Oats	12,722,733	11,436,301



THE STABLES AT RUAKURA.

COMPILED FROM MANIFESTS OF VESSELS SAILED DURING RESPECTIVE MONTHS OF CURRENT AND PRECEDING SEASONS.

Month.		Mutton, Carcases.	Lamb, Carcases.	Beef, Quarters.	Pork, Carcases.	Butter, Boxes.	Cheese, Crates.	Wool, Bales.	Wheat, Sacks.	Oats, Sacks.	Rabbits, Crates.	Hemp, Bales.	Tow, Bales.	Kauri-gum, Pkgs.
January,	1916	166,700	295,170	41,726	179	108,593	101,917	92,849	..	..	..	7,438	1,666	1,218
,,	1915	137,816	296,439	45,622	339	138,081	85,123	87,393	..	..	2,860	683	..	1,209
February,	1915	433,585	517,581	77,421	311	119,371	96,090	159,347	..	..	..	13,111	6,619	2,763
,,	1914	354,190	334,207	14,100	3	86,570	59,532	127,372	..	4	..	3,709	633	7,607
March,	1915	80,439	203,480	30,176	..	55,280	51,811	49,809	..	..	..	8,410	185	274
,,	1914	446,522	551,313	36,689	..	61,060	62,732	95,175	..	..	..	8,187	2,562	3,958
April,	1915	286,155	328,779	45,340	..	6,703	38,561	41,371	..	..	1,011	9,328	1,474	3,461
,,	1914	234,765	366,786	22,185	..	7,822	63,796	58,488	..	2,901	..	1,247	888	5,909
May,	1915	257,953	433,831	34,780	655	148	17,065	21,615	..	..	2,923	4,968	808	2,636
,,	1914	336,632	638,397	39,315	54	837	37,776	43,364	3,623	11,062	..	8,355	2,112	9,316
June,	1915	99,080	154,785	19,316	932	..	26,869	11,946	..	..	9,800	5,027	1,320	1,229
,,	1914	261,877	634,981	36,400	..	1,153	19,247	18,774	..	28,141	1,000	7,924	4,258	7,881
July,	1915	243,420	340,476	21,231	154	..	21,520	16,039	..	..	5,968	5,068	1,639	4,184
,,	1914	225,411	239,143	38,170	..	1,355	2,003	15,868	..	1,425	1,000	5,810	2,584	8,053
August,	1915	510,418	570,381	51,750	35	..	18,287	19,416	..	..	31,790	7,138	1,460	4,848
,,	1914	84,251	63,111	19,094	516	1,979	50	4,845	600	38,220	10,403	367	245	3,705
September,	1915	299,715	330,643	59,487	..	26,416	2,595	5,360	..	..	7,750	2,022	3,091	595
,,	1914	53,386	49,200	2,353	..	15,885	..	3,337	..	5,896	7,288	1,143	57	..
October,	1915	367,198	417,794	87,104	..	111,468	49,160	7,272	..	..	56,636	5,650	1,645	1,230
,,	1914	291,432	128,016	49,104	..	81,842	30,487	8,938	..	68,660	38,121	2,042	1,650	1,683
November,	1915	93,777	92,601	21,609	..	81,102	47,243	18,715	..	..	13,538	5,064	1,789	868
,,	1914	136,346	27,577	48,302	27	98,729	70,048	37,604	15	24,289	35,783	885	110	1,377
December,	1915	91,124	59,231	36,467	..	214,967	81,939	33,527	..	..	3,052	6,016	1,940	5,555
,,	1914	192,952	149,835	44,876	..	172,990	80,144	86,317	..	..	9,306	1,136	116	2,157

LONDON MARKET VALUES.

…ARATIVE STATEMENT COMPILED FROM THE HIGH COMMISSIONER'S CABLES FOR THE PAST THREE MONTHS.

London Date.	Wool. Bradford Quotations for Tops. 36's.	40's.	44's.	50's.	56's.	60's.	Mutton. Canterbury.	Mutton. North Island.	Lamb. Canterbury.	Lamb. Other than Canterbury.	Beef. New Zealand Hinds.	Beef. New Zealand Fores.	Butter. Danish.	Butter. New Zealand.	Cheese. New Zealand White.	Cheese. New Zealand Coloured.	Cheese. Canadian.	Hemp (Spot). New Zealand Good-fair.	Hemp (Spot). New Zealand Fair.	Hemp (Spot). Manila Fair (New Grade).	Hemp (Forward Shipment). New Zealand Good-fair.	Hemp (Forward Shipment). New Zealand Fair.	Hemp (Forward Shipment). Manila Fair (New Grade).	Wheat. Short-berried.	Wheat. Long-berried.	Oats. Sparrowbills.	Oats. Danish.
							d.	d.	d.	d.	d.	d.															
1915. Nov. 7	..	..	..	..	..	..	7¼	..	8	..	5⅜	4⅜	162/0	161/0	83/0	83/0	84/0	35/0/0	33/0/0	42/0/0	34/10/0	32/10/0	..	..	..	..	..
" 13	..	..	..	..	..	..	7⅛	..	7⅞	7¾	5¼	4½	172/0	..	..	..	87/0	36/0/0	34/0/0	41/10/0	35/10/0	33/10/0	41/0/0	..	..	..	..
" 19	..	..	..	..	..	..	7	..	7⅞	7⅞	5¼	4¾	178/0	162/0	..	..	88/0	36/0/0	34/0/0	41/10/0	35/10/0	33/10/0	41/0/0	..	..	..	..
" 27	..	..	..	..	..	..	7	..	7½	7⅞	5½	4¾	180/0	164/0	..	..	91/0	35/10/0	33/10/0	42/0/0	35/0/0	33/0/0	41/10/0	..	..	..	..
Dec. 4	..	..	..	..	..	..	7	..	7½	7⅞	..	..	181/0	167/0	90/0	89/0	91/0	36/0/0	34/10/0	44/10/0	35/10/0	33/10/0	44/0/0	..	..	..	..
" 11	..	..	..	..	..	..	7	..	7½	7⅞	5½	4¾	168/0	165/0	90/0	91/0	92/0	36/10/0	35/0/0	44/10/0	36/0/0	34/0/0	44/0/0	..	..	..	..
" 18	..	..	..	..	..	..	..	..	7½	7⅞	6½	5½	172/0	156/0	91/0	92/0	92/0	37/10/0	35/10/0	45/0/0	37/0/0	35/0/0	44/10/0	..	..	..	..
" 24	..	..	..	..	..	..	7¼	..	7½	7⅞	5⅞	5	164/0	150/0	92/0	91/0	94/0	39/0/0	37/0/0	46/0/0	38/0/0	36/0/0	45/0/0	..	..	..	..
" 31	..	..	..	..	..	..	7½	..	7½	7½	6	5	153/0	142/0	93/0	92/0	94/0	39/10/0	37/10/0	48/10/0	38/10/0	36/10/0	47/10/0	..	..	..	..
1916. Jan. 8	..	..	..	..	..	..	7½	..	7¾	..	6¼	5½	156/0	148/0	94/0	93/0	97/0	..	..	..	40/10/0	38/10/0	50/0/0	..	..	..	..
" 15	..	..	..	..	..	..	7½	..	7¾	7¾	..	..	158/0	152/0	98/0	98/0	99/0	41/10/0	40/0/0	51/0/0	41/0/0	39/0/0	50/0/0	..	..	..	..
" 22	..	..	..	..	..	..	7⅝	..	7⅞	7¾	..	..	158/0	146/0	98/0	98/0	99/0	45/0/0	43/0/0	55/0/0	44/0/0	42/0/0	..	..	..	..	..
" 29	..	..	..	..	..	..	7⅝	..	7⅞	7⅞	..	..	157/0	146/0	98/0	98/0	99/0	47/10/0	46/0/0	55/0/0	46/10/0	45/0/0	54/0/0	..	..	..	..
Feb. 5	..	..	..	..	..	..	7⅝	..	7⅞	7⅞	6⅛	5½	157/0	151/0	98/0	98/0	99/0	47/10/0	45/10/0	55/0/0	47/0/0	45/0/0	54/0/0	..	..	..	..
[illegible]							[illegible]	[illegible]	8	8	[illegible]	[illegible]	160/0	[illegible]	..		97/0										

STOCK EXPORTED.

THE following table shows the number and descriptions of stock exported from the Dominion during the month of January, 1916:—

Port of Shipment.	Horses.		Sheep.			Cattle.		Pigs.	Dogs.
	To Australia.	To Eastern Pacific.	To Australia.	To Eastern Pacific.	To Montevideo.	To Australia.	To Eastern Pacific.	To Eastern Pacific.	To Eastern Pacific.
Auckland ..	3	4	..	86	..	..	13	51	..
Gisborne ..	..	..	..	..	..	..	..		..
Napier ..	..	..	..	..	..	..	..	..	..
Wellington ..	2	..	16	..	..	..	..	..	..
Lyttelton ..	..	..	213		2	..	..	..	..
Dunedin ..	..	..	4	..	..		..	..	..
Bluff	..	..	101		..	..	..	..	..
Totals ..	5	4	334	86	2	..	13	51	..

The following are particulars of horses shipped: 5 thoroughbreds (1 horse, 1 mare, 3 fillies), 2 medium-draught geldings, 2 harness geldings.

Auckland also exported two crates of poultry.

STOCK IN QUARANTINE.

THE following stock was received into quarantine during the month of January, 1916:—

No.	Description.	Sex.	Port of Origin.	Owner or Agent.	Address.
			MOTUIHI ISLAND (AUCKLAND).		
2	Aberdeen Angus calves	Male ..	Born in quarantine	J. D. Ritchie ..	Wellington.
			SOMES ISLAND (WELLINGTON).		
1	Collie dog ..	Male ..	London ..	R. Armstrong ..	Masterton.
2	,, dogs ..	,, ..	,,	C. L. Hay ..	Wanganui.
3	Ayrshire cattle..	1 male, 2 female	,, ..	Mental Hospitals Department	Wellington.
			QUAIL ISLAND (LYTTELTON).		
1	Collie dog ..	Male ..	London ..	J. Mackenzie ..	Dipton.
1	,, bitch ..	Female	,, ..	William Lumsden	Palmerston.

HEMP AND TOW GRADING RETURNS.

JANUARY.

Hemp.—The total number of bales graded was 10,823, as compared with 6,943 for the corresponding month of last year, an increase of 3,880 bales. For the twelve months ending 31st January, 1916, the number of bales graded was 124,702, as compared with 93,301 for the previous twelve months, an increase of 31,401 bales.

Tow.—During the month 3,234 bales were dealt with, as compared with 1,901 for the corresponding month of last year, an increase of 1,333 bales. For the twelve months ending 31st January, 1916, the number of bales graded was 34,303, as compared with 27,618 for the previous twelve months, an increase of 6,685 bales.

Stripper-slips.—The number of bales graded was 831, as compared with 115 for the corresponding month of last year, an increase of 716 bales. For the twelve months ending 31st January, 1916, the number of bales graded was 4,773, as compared with 1,274 for the previous twelve months, an increase of 3,499 bales.

HEMP, TOW, AND STRIPPER-SLIPS GRADED THROUGHOUT THE DOMINION DURING THE MONTH OF JANUARY, 1916.

Hemp.

Port	Superior.	Fine.	Good-fair.	Fair.		Common.	Rejected.	Condemned.	Total.
				High Point.	Low Point.				
	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.
Auckland ..	..	..	118	755	548	154	8	8	1,591
Napier ..	..	..	66	2	..	..	..	..	68
Wairoa ..	..	..	..	..	..	..	..	..	..
Foxton ..	..	..	777	1,791	948	387	57	29	3,989
Wellington ..	..	..	446	2,526	712	53	52	..	3,789
Picton ..	..	122	10	..	..	..	..	..	132
Blenheim ..	..	..	78	..	..	..	..	..	78
Lyttelton ..	..	..	..	..	..	..	..	..	..
Dunedin ..	..	..	91	116	..	..	..	..	207
Bluff ..	..	..	256	640	73	..	..	..	969
Totals ..	..	122	1,842	5,830	2,281	594	117	37	10,823
Percentages of totals	..	1·13	17·02	53·87	21·07	5·49	1·08	0·34	..

Tow.

Port.	First Grade.	Second Grade.	Third Grade.	Condemned.	Total.
	Bales.	Bales.	Bales.	Bales.	Bales.
Auckland ..	..	122	561	25	708
Napier	..	..	13	..	13
Foxton	284	397	162	..	843
Wellington ..	86	824	206	21	1,137
Picton	..	44	..	..	44
Blenheim ..	55	..	..	..	55
Lyttelton ..	..	..	..	..	..
Dunedin ..	..	103	..	..	103
Bluff	..	156	162	13	331
Totals ..	425	1,646	1,104	59	3,234

Stripper-slips.—Foxton: First grade, 30; second grade, 284. Wellington: First grade, 56; second grade, 425. Blenheim: Second grade, 2. Dunedin: Second grade 1. Bluff: Second grade, 21. Condemned: Auckland, 4; Wellington, 8.

The

Journal of Agriculture.

WELLINGTON, NEW ZEALAND.

20TH MARCH, 1916.

WEEDS AND THEIR IDENTIFICATION.

CONTINUED.

ESMOND ATKINSON, Biological Assistant.

THISTLES.

IF *we consider their great abundance throughout the country and* their powers of spreading rapidly both by seeds and roots, we must rank the various species of thistles found in New Zealand as among the most important weeds with which the farmer has to deal. In this article six of the commonest species are described and illustrated. These are :—

Spear thistle (*Carduus lanceolatus*).
Nodding thistle (*Carduus nutans*).
Winged thistle (*Carduus pycnocephalus*).
Californian thistle (*Carduus arvensis*).
Milk thistle (*Carduus Marianus*).
Woolly-headed thistle (*Carduus eriophorus*).

IDENTIFICATION.

Stems winged.

Heads large, upright, with narrow spines .. *Carduus lanceolatus.*
Heads large, drooping, with broad spines .. *Carduus nutans.*
Heads small, clustered .. .. .. *Carduus pycnocephalus.*

Stems not winged.

Plant with creeping underground stems .. *Carduus arvensis.*
Plants without creeping underground stems—
Leaves very large, with white veins .. *Carduus Marianus.*
Leaves smaller, without white veins .. *Carduus eriophorus.*

This key is not intended to show the botanical relationships of the different thistles, but merely to provide a quick means of distinguishing them from one another. The genus *Carduus* is divided by some botanists into two genera, *Cnicus* and *Carduus* proper, the species of the former genus having feathery pappus-hairs, while those of the latter have simple pappus-hairs. By this classification two of the species, nodding thistle and winged thistle, would remain in the genus *Carduus*, the others being placed in *Cnicus*, except milk thistle, which is often separated from the rest and made to constitute the genus *Silybum*. The differences between the three genera are not important, however, and in this article all will be included under *Carduus*.

SPEAR THISTLE.

Spear thistle is a rather stout and much-branched plant, growing usually to a height of from 2 ft. to 4 ft. Being biennial, this thistle does not produce flowers till the second season, the first-year plant consisting of a stout and long, only slightly branched tap-root, bearing at its crown a rosette of spreading leaves which are strongly lobed and prickly, dark green above and whitish beneath.

The stem, which is stout at its base, though rather slender in the ultimate branches, and is everywhere hairy, is irregularly winged for most of its length. The stem leaves are unlike the radical leaves in being shorter, narrower, and more pointed, and in having fewer, narrower, and longer lobes. The heads are rather large (1 in. to 1½ in. long by about the same in diameter), erect, solitary or two or three together at the tips of the branches. The involucre is egg-shaped, and each of the numerous bracts ends in a narrow, spreading spine, those towards the base of the head being recurved. A slight cottony web is found on the involucre, but it is insignificant in comparison with that of woolly-headed thistle. The florets are purple inclining to reddish. As the achenes ripen, the involucre opens out and becomes cup-like

Str.
First grade
grade 1.

SPEAR THISTLE.
Rather less than half natural size.

in shape, and is filled with the whitish feathery pappus-hairs, which soon become freed from one another and from the involucre and float away as the thistle-down so common on windy days in the late summer.

It is not known accurately how far the "seeds" are carried in this way. It varies with the different species, and also depends on external conditions, such as the dampness of the weather and the strength of the wind.

Spear thistle is very commonly known in this country as "Scotch" thistle.

NODDING THISTLE.

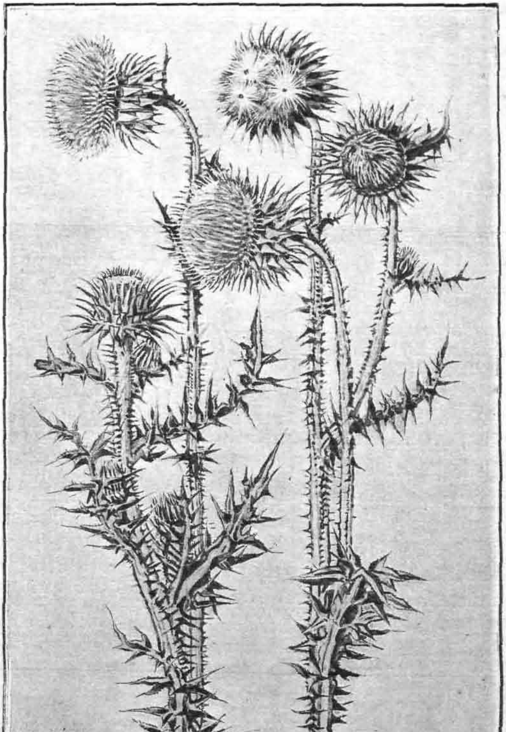
Like spear thistle, nodding thistle is a tall and stout biennial, but it does not form as broad or as symmetrical a plant, the branches arising from higher on the stem. In this respect it is more like woolly-headed thistle, presently to be described.

The stem is cottony, grooved, and, like that of the spear thistle, is winged for most of its length, but the wings are different in appearance, being much more deeply cut, very spinous, and often interrupted, so that often they are represented only by a series of prickles with more or less expanded bases. The leaves are deeply cut into many narrow lobes pointing alternately upwards and downwards; both surfaces of the leaf are more or less clothed with short hairs, and the veins beneath are woolly. The flower-heads differ from those of spear thistle in being larger (2 in. or more in diameter) and not so elongated, and also in their being drooping and not erect, this character having given the thistle its common name. The spines of the involucral bracts are also very distinctive, being three or four times as wide. The florets are of much the same purple colour as those of spear thistle, but the pappus-hairs are simple and not feathery. The flowers of nodding thistle have a rather strong and pleasant scent, which has given it the name by which it is sometimes known, "musk thistle."

WINGED THISTLE.

This thistle is a more slender plant than the two preceding ones, and is an annual, flowering in the first season from seed. The leaves are broad in proportion to their length, cottony beneath, waved and prickly on the margin, but not so deeply cut as those of either spear or nodding thistles. In all three plants the leaves are continued down the stem as wings, but winged thistle is aptly enough named, as the wings are very much broader than in the other two plants, and are more conspicuous through their being ntinuous all down the stem. The flower-heads are altogether rent, as they are much smaller (1 in. or less long) and grow

First grade



NODDING THISTLE.
Rather less than half natural size.

the height of 6 ft., and having leaves sometimes 2 ft. long, though they are often smaller. Besides being longer, the leaves are broader and less deeply lobed than those of the other thistles. The heads are large and solitary, with egg-shaped involucres armed with very long and stout spines, which spread to a diameter of 3 in. or more, and are themselves armed with prickles at their bases. The florets are purple, and the pappus-hairs of the achenes which follow them are rather short, and are not clothed with feathery hairs, but are quite simple.

WOOLLY-HEADED THISTLE.

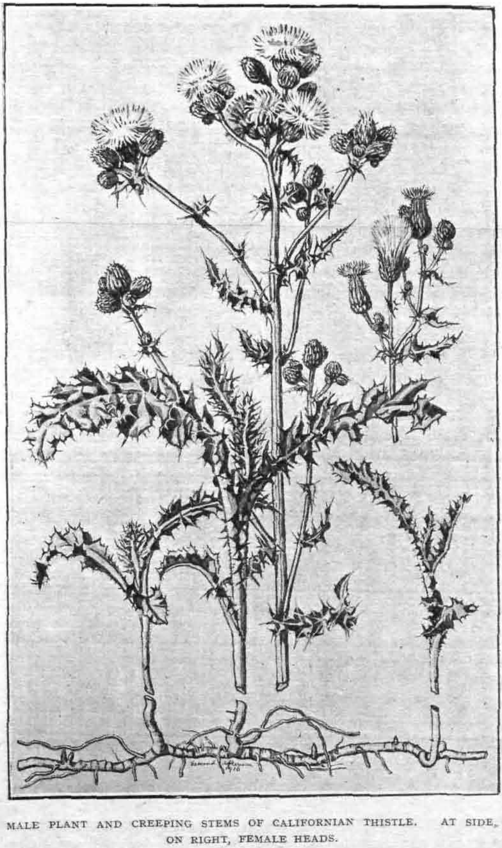
Although in the key this thistle is placed in a different section from spear thistle, owing to its not having a winged stem, it is closer to that plant in general appearance than to any other of the naturalized thistles. It may be at once separated from milk thistle, which is next to it in the artificial key, by its narrow leaves without white veins, woolly stem, and clustered cobwebby heads. From spear thistle it is distinguished by its less deeply lobed leaves, which are decidedly white beneath; by its very stout strongly corrugated stems, which are entirely without wings; and by its densely woolly heads, which look as if a spider had been spinning its web on them. When the two species are growing together woolly-headed thistle may be picked out at a distance by its more upright and less bushy and spreading habit of growth.

The heads of this species are usually described as much larger than the ones shown in the illustration, but the small-headed form is apparently the typical one in New Zealand. The pappus-hairs are feathery, and are like those of spear thistle, but have a brownish tinge.

DISTRIBUTION AND IMPORTANCE AS WEEDS.

Of the six thistles described above, three may be spoken of as widely distributed (spear, Californian, and winged thistles), one (milk thistle) as common in many places but rather local, while the two remaining plants (woolly-headed and nodding thistles) are at present confined to quite small areas.

Spear thistle is by far the most widely spread and abundant species, being found in a great variety of soils and situations throughout both Islands. It is perhaps the most characteristic constituent of the plant covering that so constantly appears a few weeks after a bush burn, and it is usually during the first few years of settlement in bush country that it is most abundant, since it does not survive more intensive cultivation. For the same son it is not found as a crop pest, though it is one of the most



MALE PLANT AND CREEPING STEMS OF CALIFORNIAN THISTLE. AT SIDE, ON RIGHT, FEMALE HEADS.

Rather less than half natural size.

frequent occupiers of all waste ground on the farm and elsewhere. It is spread entirely through the agency of seed, but this is produced in large quantities and over a long period, besides being well adapted for dispersal by wind.

It seems probable that the achenes are capable of remaining dormant for some time, and then germinating when favourable conditions arise. The fact that spear thistle appears in enormous quantities within a few weeks of a bush burn, and also after the reploughing of old pastures, affords evidence to support this view, since the bare ground may become populated at a time when no seed-dispersal is taking place. Achenes of spear thistles as well as of woolly-headed and nodding thistles germinated strongly in a few days after being kept for four years, and this power, together with the fact that the achenes of all these thistles have seed-coats containing oil (which protects them from decay) makes it likely that they may lie dormant in the ground for a number of years.

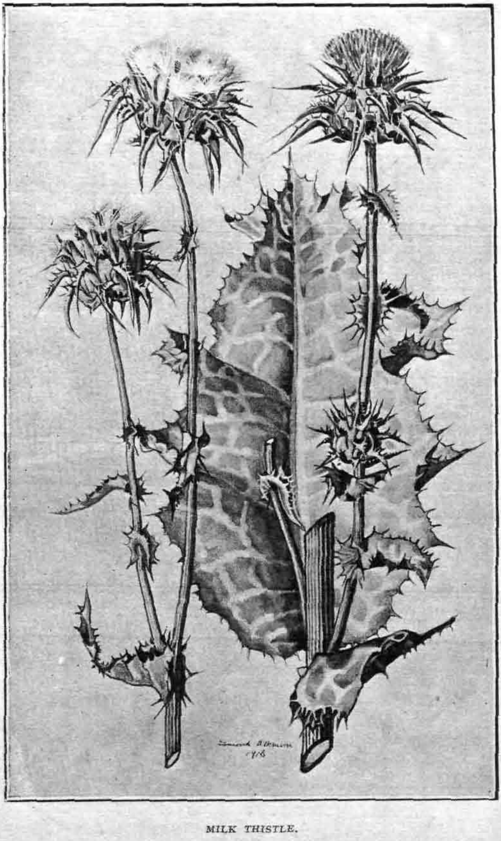
It should be mentioned that goldfinches are great destroyers of thistle "seeds," especially those of spear thistle. In many districts it is quite difficult to find whole achenes.

Little need be said here of the economic position of Californian thistle, since this subject has been fully dealt with in the *Journal* from time to time. The thistle is now widespread throughout New Zealand, and is still on the increase, though its distribution is not even. Certain districts may be called its strongholds, while it is still quite rare in others. In Marlborough lucerne has proved very effective in destroying Californian thistle, and where the former plant can be grown there is no sounder way of getting rid of the pest.

Californian-thistle rust (*Puccinia suaveolens*) has done good work this season, and the Biologist will send supplies of the fungus (as long as it is available) to any one requiring it.

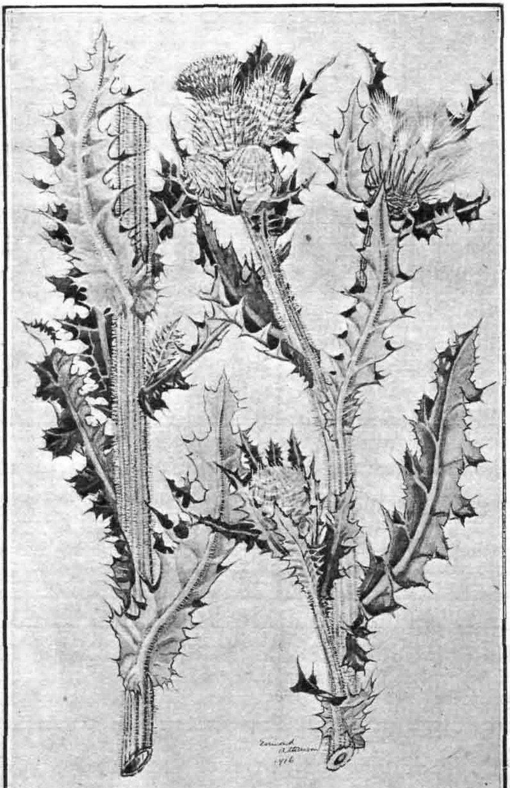
Winged thistle, though very abundant in many localities, is not nearly as generally distributed as either spear or Californian thistles. It is the most ephemeral of all the introduced thistles, ground which is covered with it in one year often being entirely free from it the next. "Seed" ripening in autumn will produce flowering plants the following spring and summer, while from spring "seed" arise plants flowering in the autumn. In many parts of the denuded areas of Central Otago it occupies a position of great economic importance, since it affords the only available winter feed for sheep.

Milk thistle is abundant in many parts of the North Island, but it is local in its distribution, and is less common in the South. It often grows in large and dense patches, smothering all other vegetation, but it never persists where thorough cultivation is carried on.



MILK THISTLE.

Rather less than half natural size.



WOOLLY-HEADED THISTLE.

Rather less than half natural size.

Both woolly-headed and nodding thistles are local plants. The former is at present confined to a part of the Wairarapa, and to the Otaki and possibly other river valleys to the west of the Tararua Range. Apparently this thistle has spread by means of "seed" carried over the range from the Wairarapa by the wind, as it is found only in the upper part of the Otaki valley—*i.e.*, in the country nearest to the original habitat. Nodding thistle is fairly common in South Canterbury, and is scattered through parts of Otago, but has been recorded from nowhere else at present.

The achenes of three of these thistles (spear, Californian, and winged) are found as impurities in various lines of agricultural seeds, both New-Zealand-grown and imported. For a full account of these impurities the reader is referred to an article by Mr. E. B. Levy in the *Journal* for June, 1915. The "seeds" of the other three have not yet been recorded as impurities, two of the plants being rather rare and local, while the third (milk thistle) has achenes of so large a size that they would dress out of most lines.

CONTROL OF THE BLACK CRICKET.

CALIFORNIAN METHODS WITH GRASSHOPPERS.

E. CLIFTON, New Zealand Commissioner, San Francisco.

In certain northern districts of New Zealand the black cricket (*Gryllus servillei*) often commits considerable depredations during the summer. The lands that usually suffer to the greatest extent are rich fertile swamps in the process of reclamation, also parts of the hilly country where, during dry hot weather, openings in the soil permit these insects to shelter.

A very similar condition due to another insect, the grasshopper, causes very appreciable damage in the Imperial Valley of California. This grasshopper is somewhat similar in its propagation habits to that of the black cricket of New Zealand. Its eggs are laid in the soil, and in the season when the insects mature their depredations commence. The most serious harm is effected when imperfect or no cultivation at all is applied. In the Imperial Valley fields of lucerne and maize, and gardens and trees, have been more or less injured. In lucerne fields from which an ordinary yield of a ton of hay per acre would have been obtained the stems alone

remain. Something similar has been seen in those northern districts of New Zealand, where areas have been stripped almost clean of vegetation.

It is recognized that although cultivation is the means of overcoming the pest in the districts affected by the black cricket in New Zealand there are serious difficulties in the way of this method. The land may have been but recently reclaimed; considerable expense must be incurred in drainage or in the clearing of stumps before cultivation may be entered upon. Cultivation will come as these operations are completed. In the fertile Imperial Valley, *wherever thorough cultivation has been applied the grasshopper pest is almost entirely avoided,* for the reason that the operation has brought to the surface and exposed to the sun the eggs of the insect. Such treatment will be the ultimate cure in New Zealand.

There remains another possibility of restriction — namely, by poisoning the matured insect. This is effected in California by the distribution of a mixture consisting of 25 lb. of bran, 1 lb. arsenic and 2 quarts molasses, in 4 gallons of water. The arsenic used is usually in the form of Paris green. The latter is mixed with, say, 1 quart of water, poured into a tub, mixed with the molasses, and the bran is added slowly until the compound becomes of the consistency of mortar. It is undesirable to pour the water containing the poison on the bran; the arsenic is then not evenly distributed. The quantity specified is estimated to be sufficient for 5 acres of land—that is, assuming that the whole area was affected. In the greater part of the country affected in New Zealand, *however, the pest is not distributed over the whole area.* Therefore, this quantity would serve a much greater acreage if distributed on those parts that the crickets affect. The poisoning method is being used over quite a large area in California, particularly for the protection of commercial market-gardens and gardens generally.

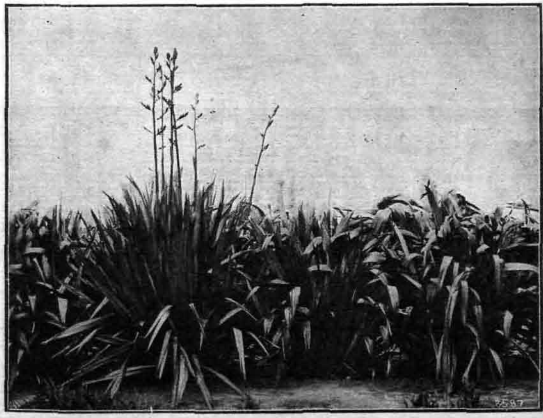
It is claimed that this compound is not attractive to stock or poultry, and therefore is not a danger to them. It may, however, be dangerous to children, and great precautions should be taken in making use of it when such condition applies.

In dealing with the grasshopper a greater difficulty is encountered than applies to the cricket. The former moves in quite large flights from place to place; the cricket has not this means of locomotion at its command. On the other hand, the grasshopper s *not shelter itself in the ground* as *does the cricket.* A grass- ier-catcher is availed of by the farmer in the form of a canvas ı covered with glutinous oil. The insects fly against the

screen and fall into a hopper below. Another means is a wide concave canvas screen of which the centre terminates in a bag net. The insects are usually caught in this and made use of for poultry-feed. This means, of course, could not be availed of in New Zealand, for on being disturbed the cricket at once seeks shelter in the ground.

It is claimed that when sheep have been pastured on land during the winter and spring but a relatively small number of grasshoppers appear. This is supposed to be due to the trampling of the ground by the stock.

The summary of recommendations for the farmer in California—and which may be applied with modifications to New Zealand—is in the first instance thorough cultivation, and in the second poisoning.



PHORMIUM VARIETIES AT WERAROA EXPERIMENTAL FARM.

A STUDY IN BREEDING.

W. M. SINGLETON, Assistant Director, Dairy Division.

Two of our most prominent certificate-of-record purebred dairy cows represent a phase of breeding which is considered by some authorities to be so much along modern lines that it has been deemed advisable to draw the attention of readers of the *Journal* to the matter. The well-known Jersey, Lady of Collingwood, which holds the highest record for the four-year-old class of that breed, and Minnie of Glenweir, the highest-producing mature Ayrshire, are the animals referred to.

It will suit the purpose best to first set out the tabulated pedigree of Minnie of Glenweir as it appears on page 59, Volume iv, of the Ayrshire Herd-book, as follows :—

Minnie of Glenweir	King Cole ..	King's Pride ..	*Ayrshire King* ..	Teviot. Bluebell.
			Oamaru Queen ..	Sir Robert Stout. Flower.
		Winnie ..	First Choice ..	Baron Oxhill (Imp.). Maid of the Glen.
			Queen II ..	Tahuna. Queen I.
	Minnie IV ..	McAllum's Pride	Victory.. ..	Bobbie Burns. Minerva.
			Queen Mary ..	*Ayrshire King.* Duchess II.
		Minnie III ..	Sir William ..	*Ayrshire King.* Snowdrop.
			Minnie II ..	Bruce. Pudge.

Attention is directed to Ayrshire King. This is one of the most noted Ayrshire bulls that have been in service in New Zealand, and that concentration of his blood indicated in the pedigree was undoubtedly most successful. A number of the earlier Ayrshire breeders have expressed the opinion that Ayrshire's King's daughters were exceptionally good producers, and the certificates of record which Messrs. Weir Bros. have received on the yields of his descendants go to substantiate these earlier experiences.

LINE BREEDING.

It will be noted that on the sire's side there are two generations between Minnie of Glenweir and Ayrshire King, while on the dam's side there are three such generations, making five "free" generations in all. In this connection a quotation is

apropos from the Research Committee on Animal Breeding in their review of the work as it is carried on at various agricultural experimental stations in the United States. They state, "It has been found, to carry the matter a step further, that most winning racehorses during the last half-century have had five 'free' generations; prior to that four 'free' generations was the rule. When there are no 'free' generations, thoroughbreds are likely to be deficient in vigour; where there are more than five 'free' generations they fail, because their speed has been swamped by outcrossing or lost by reversion." It will be seen that Minnie of Glenweir's pedigree has followed "winning" lines. It is obvious that the excellence of the individual whose transmissible factors are being concentrated is of paramount importance.

The foregoing pedigree affords a splendid example of line breeding. The distinction between line breeding and inbreeding is one of degree, line breeding being described as the mating of two individuals whose blood lines are the same from about 25 to not more than 50 per cent. If they are common to 50 per cent. or more it is termed inbreeding rather than line breeding. Inbreeding would be obtained by mating a sire with his daughter, a mother with her son, and a half-brother and sister. Lady of the South in Lady of Collingwood's pedigree would also be considered inbred, since her sire and dam have each 50 per cent. in common from K.C.B. Line breeding also suggests that the various sires used have each some of the hereditary factors of a common ancestor.

INBREEDING.

The pedigree of Lady of Collingwood is even more striking, so far as the appearance of common ancestors is concerned. In tabulated form it appears thus:—

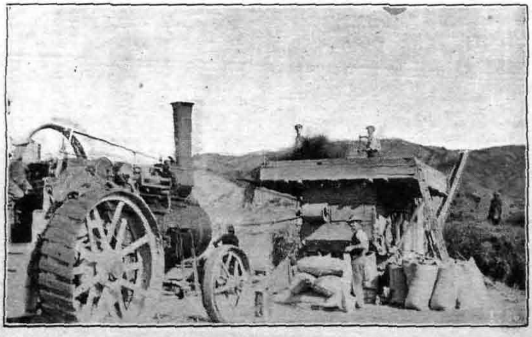
Lady of Collingwood	Bilberry's Member	M.L.C.	*K.C.B.* (Imp.) ..	..
			Sunflower V ..	Monologue.
				Sunflower III.
		Bilberry III ..	Monologue ..	Monopoly II.
				Victoria II.
			Bilberry I ..	Monopoly II.
				Mulberry IV.
	Lady of the South	Sungod's Member	Sungod	*K.C.B.* (Imp.).
				Sunflower II.
			Bluebell IV ..	*K.C.B.* (Imp.).
				Bluebell II.
		Roses Sweet ..	Knight Commander	*K.C.B.* (Imp.).
				Victoria III.
			Sweetbrier VII ..	*K.C.B.* (Imp.).
				Sweetbrier II.

The outstanding feature of this pedigree is the frequent appearance of K.C.B. — a Jersey bull with eleven certificate-of-record daughters. To use a breeder's parlance, Lady of the South had

50 per cent. of her blood from K.C.B. With her was mated a grandson of K.C.B., the offspring being Lady of Collingwood. Not only was there concentration of the hereditary factors from K.C.B., but were this pedigree extended three generations further it would be found that other ancestors appear more than once. Some of these are Monologue, Monopoly II, Dry Monopole, Monopoly (Imp.), Victoria, Sunflower, Mulberry IV, &c. In the sixth generation behind Lady of Collingwood, of sixty-four ancestors, the writer has counted forty-two which appear twice or in the earlier generations. In the next generation 70 per cent. of the ancestors appear twice or elsewhere, making this cow at least 70 per cent. inbred.

CONSTITUTIONAL EFFECTS.

Neither her inbreeding nor her three consecutive years of high butter-fat production seem to have had any deleterious effect on Lady of Collingwood's constitution. It is generally held that inbreeding impairs constitution. It cannot be maintained that this is invariably the case where proper judgment is exercised. Line breeding appears to be coming more into practice with the most progressive breeders, but the uninitiated must remember that such matings are likely to accentuate any unfavourable factors as well as the desirable. No important transmissible defects should form a part of the animal whose blood is being concentrated by line breeding or inbreeding.



THRESHING LUCERNE-SEED ON THE PAKOWHAI ESTATE, POVERTY BAY.

COMBINED SPRAYING.

A CHEMICAL GUIDE CHART FOR FRUITGROWERS.

THE introduction of time- and labour-saving devices is, generally speaking, a sound policy, but it only remains sound as long as it can be accomplished without unduly interfering with efficiency.

The fruitgrower has usually more than sufficient work on hand to keep him fully occupied, and is naturally only too anxious to cut out as much labour as he possibly can, and to otherwise lessen the cost of running his orchard. The principal time-saving innovations adopted by the orchardist, particularly during the last few years, may be stated as follows: Power-spraying outfits; improved implements for cultivating the soil; the disposal of the product of the orchard in bulk to properly established trading and packing firms, thereby avoiding all the labour entailed in grading, packing, and marketing fruit; and the utilization of suitable ready-made spraying-compounds with a view to controlling two or more diseases of a different class with the labour of one application. By these means, in general, orchard work can be more readily and effectively carried out than it could be at any time in the past. In regard to spray mixtures, however, a great amount of care has still to be exercised. The temptation to use a prepared spray mixture rather than go to the trouble of procuring and mixing the separate ingredients in the orchard is such that many are apt to adopt this course regardless of the effect it may have on the disease it is intended to control.

Again, in the combining of two or more spraying-compounds—a matter with which these notes are mainly concerned—the same temptation to save labour exists. Certain spraying-compounds are held to be improved by combination, while others remain unaffected; on the other hand, a great many of the ingredients and mixtures used for spraying purposes are very materially affected when unwisely combined. It is therefore undesirable to apply the method of combining spray mixtures for the purpose of controlling diseases of a different class without having some previous knowledge of the result.

The average fruitgrower has little or no knowledge of chemistry or of the chemical action likely to take place when the constituents

A CHEMICAL GUIDE CHART FOR FRUITGROWERS.

DIAGRAM SHOWING THE EFFECT OF MIXING VARIOUS SPRAYING-COMPOUNDS, BASED UPON A COMPATABILITY TABLE BY G. F. GRAY, CALIFORNIA, IN "BETTER FRUIT," AND INVESTIGATIONS BY W. C. MORRIS, HASTINGS, NEW ZEALAND.

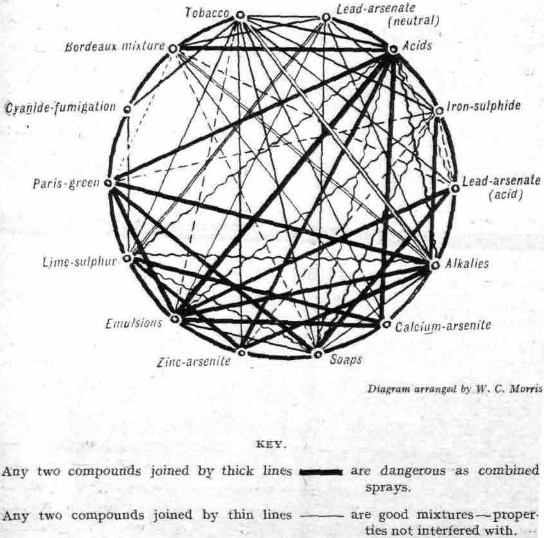


Diagram arranged by W. C. Morris

KEY.

Any two compounds joined by thick lines ▬▬ are dangerous as combined sprays.

Any two compounds joined by thin lines —— are good mixtures—properties not interfered with.

Any two compounds joined by dash lines - - - - are excellent mixtures—mixing improves them.

Any two compounds joined by two thin lines ═══ are efficient and non-injurious—mixing does not improve them.

Any two compounds joined by wavy lines ∿∿∿ are inefficient and non-injurious—of no use mixed.

of two separate spraying-compounds are combined. While it is generally recognized in regard to fruit-tree spraying that the practical demonstration on the tree is the final test, and is altogether more reliable than that of the laboratory, there are certain chemical laws some knowledge of which would no doubt act as a sufficient warning against combining unsuitable ingredients.

In order to lessen the need of this knowledge of chemistry in respect to the ordinary ingredients and compounds used for spraying purposes, and to present the facts in a handy form, Mr. W. C. Morris, Agricultural Instructor to the Hawke's Bay Education Board, has drawn up the chart here reproduced. Mr. Morris wishes it to be clearly understood that the chart is submitted merely as a guide, and is based on an article which appeared in the August, 1914, issue of "Better Fruit," a United States publication; also that the decisions arrived at, although based on laboratory tests, are generally supported by practical experience.

A careful study of this chart would no doubt prove of value to any one contemplating the combination of spraying-compounds the effect of which they have had no previous experience of. The spraying-compounds and terms used in connection with the chart refer only to those in common use for spraying purposes. "Emulsions" means any class of oil emulsion, soaps, fish-oil, whale-oil, or other soaps used in spraying. "Acids" and "alkalies" mean any ingredient showing an acid or alkaline litmus-paper test respectively.

The danger of cyanide both as a poison and as a destroyer of foliage when improperly used in the fumigation of plants is generally well known. It is not intended to convey the impression by the chart that cyanide can be safely used in conjunction with other ingredients for spraying purposes, but rather that the danger to plants is greater when fumigation is carried out immediately after spraying with Bordeaux mixture or Paris green, and that the contrary is the case in regard to tobacco-wash or lime-sulphur.—*J. A. Campbell, Assistant Director, Horticulture Division.*

Californian-thistle Rust. — Fields Inspector Webb, Masterton, writes: "Californian-thistle rust has made rapid strides in this district, the settlers assisting by spreading it as suggested by the Biologist. I have sent several affected plants to non-affected areas. All have taken this season, and have done an immense amount of good in the direction of controlling the weed."

RYE-CORN STRAW FOR THATCHING.

A. W. GREEN, Manager, Ruakura Farm of Instruction.

MUCH difficulty is often experienced by farmers in obtaining thatching-material for stacks and other purposes. Rushes have been the chief stand-by, but with the steady spread of cultivation and land-clearing generally this material is becoming scarce in many

RYE-CORN AT RUAKURA CUT GREEN FOR THATCHING.

localities. Even where they abound considerable labour is required to cut sufficient rushes to thatch a few small stacks.

Fortunately, a first-class thatching-material can be grown on any arable farm. Cut at the right stage, there is no better material for this purpose than rye-corn straw. Farmers will find it a good practice when putting in cereal crops to sow a small proportion of the field with rye-corn, thus anticipating requirements for stacks after the harvest. Half an acre of rye will provide enough thatch for 20 acres of crop of average bulk.

Rye-corn may be either sown in autumn and fed off, or in early spring for continuous growth. The usual seeding is 2 bushels

per acre, and a very suitable manure is basic superphosphate at the rate of 3 cwt. per acre.

The proper time to cut rye-corn for thatch is when the head is in the flowering stage, a tough straw being then obtained. If the rye is allowed to mature further the straw becomes brittle, and is not nearly so suitable for thatching. Moreover, mature heads may germinate on the stack in moist weather. The rye for thatching can be cut green with the reaper-and-binder before the harvest rush is on, and by the time the grain crops are ready for stacking the rye will be dry enough to use for immediate thatching.

STACK OF MEADOW HAY AT RUAKURA THATCHED WITH RYE-CORN STRAW.

A useful feature of rye-corn is that it can be successfully grown in sour swamp soils, where both wheat and barley would fail. On such soils sorrel is usually abundant. Few crops will kill out sorrel to such an extent as a heavy growth of rye-corn.

At Ruakura this season an area of 12 acres of rye-corn was grown. The crop was sown on the 3rd September and made splendid growth, attaining a height of over 6 ft. Early in December 6 acres were cut in the flowering stage, giving about 3½ tons per acre of thatching-material—an exceptionally good yield. The accompanying photograph shows this part of the crop drying in stook, with the maturing portion of the rye to the left.

Twenty-two large stacks of cereals, lucerne hay, and meadow hay, at Ruakura, have been thatched with this rye-corn. A quantity has also been reserved for thatching the pig-shelters. In addition, a fair bulk has been sold to neighbouring farmers, while more inquiries have been received for the material than could be satisfied.

The field in which the rye-corn was grown was reclaimed from swamp a few years ago, and is still sour and sorrely. Barley grown next the rye-corn was almost a failure. On the part occupied by the rye-corn the sorrel has been pretty well smothered out.

TOMATO-FRUIT DISEASES.

CURRENT INVESTIGATIONS.

R. WATERS, Biological Assistant.

TOMATO-FRUIT in the vicinity of Carterton, Wairarapa, has been affected this season by several diseases, one of which appears to have been not recorded so far in New Zealand. As this disease was suspected of causing diarrhœa and similar illness to the consumers of affected fruit, a rapid investigation was undertaken, and the following notes are presented for the information of growers generally. The crops dealt with were growing out-of-doors.

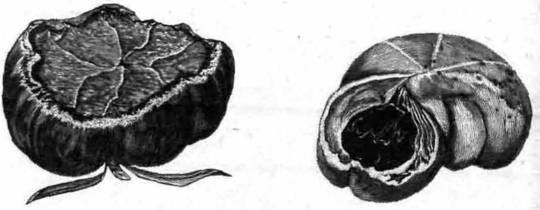
The root, stem, and leaves of the tomato-plants examined were practically free from disease. On the fruit, however, three apparently separate affections were found—namely, (1) Tomato black-rot (*Macrosporium tomato*), (2) circular white patch, and (3) premature softening.

TOMATO BLACK-ROT (*Macrosporium tomato*).

Attention has previously been drawn in the publications of the Department to this very destructive disease, which doubtless is now well known to many growers. The disease on the present occasion was found prevalent particularly amongst the more wrinkled varieties, which often seemed to expose internal tissues through unequal growth tearing the flesh about the blossom end. Dark spots appear, especially toward this end, and these spots enlarge until more than half the fruit may be flat or sunken (Figs. 1 and 2). On such injured surfaces black or greenish-black velvety

mould occurs, bearing enormous numbers of minute olive-green spores (Fig. 3). By the latter appearance the disease may be detected.

Though formerly tomato black-rot was regarded as distinct from potato leaf-curl (*Macrosporium solani*), more recent observers are inclined to believe that the two are identical; growers would



TOMATO BLACK-ROT.

Fig. 1 (on left).—Typical appearance of a badly affected fruit. Fig. 2 (on right).—Fruit attacked at the side.

therefore be well advised at least to treat them as such. When the fungus is established upon a ripening crop, as in this case, the collection and the destruction by burning or by burying deeply all affected fruit is the best treatment that can be advised. Simultaneous Bordeaux spraying limits the infection of unaffected fruit. As soon as the crops are harvested it is necessary to destroy similarly all diseased tomato or potato material. The following season the crop should advisedly be grown on land not previously occupied for some years by either tomatoes or potatoes. Damp or badly drained land and badly ventilated glasshouses encourage black-rot, and it spreads rapidly in plants only partly supported or altogether growing over the ground. Fresh stable manure should not be used. Early and thereafter regular applications of Bordeaux mixture next season would do much to prevent a recurrence of an attack.

TOMATO BLACK-ROT.

Fig. 3.—Spores of the Attacking Fungus. Highly magnified.

CIRCULAR WHITE PATCH.

Treating of this affection, there were observed to be common on the upper surfaces of the fruit directly exposed to the midday sun large patches, first appearing as light-yellowish areas in the skin and the firmer thick fleshy tissue just beneath, which latter together form the casing holding the pulp and give the shape to the fruit. Outside of these areas the fruit was reddening as usual. Later the tissues of the bleached patches collapsed into sunken, flat, somewhat circular, finely wrinkled white patches, sometimes over an inch in diameter. The firm tissue under the skin by this time had dried, adhering closely to the under-side of the skin, with which it then formed a thin casing expanding to normal

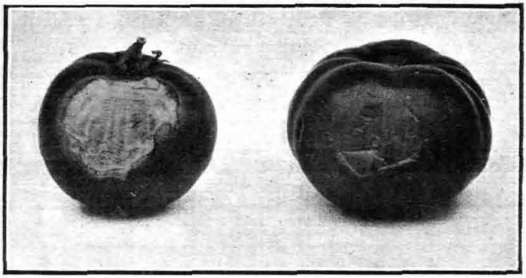


FIG. 4.—TOMATOES AFFECTED WITH CIRCULAR WHITE PATCH.

thickness only at the periphery of the circle. Under these patches the pulp surrounding the seeds was moist and sometimes milky white. This was seen under the microscope to be due to the accumulation in the pulp-cells of enormous numbers of starch granules, which also were abundant in the cells of the dried skin and adjacent tissue.

The general appearance of this affection is so distinctive that it should readily be correlated with any previous description had it been recorded. So far, however, I have been unable to find any mention of such injury, nor could any traces of a causative fungus be found. The conversion of soluble reserve food into starch, which accumulates in granules, takes place under ordinary

circumstances as the fruit develops. These granules are later reduced to a sugar or similar soluble form, in which some of it may then pass on to the seeds or other growing parts requiring nourishment. The assemblage of granules in such enormous numbers as in the cases noted, however, is quite extraordinary, and somewhat discounts the likelihood of the trouble being due to an organism which was drawing upon and reducing the reserve material. I am inclined to regard the disease as a physiological one brought on by some unfavourable weather-conditions, of which the heat of the sun acting upon the previously damaged portions caused the final dried and bleached appearance. Nevertheless specimens will be kept under observation. Should any grower have had experience with this trouble the Biology Section of the Department would be glad to co-operate with him in arriving at its origin.

PREMATURE SOFTENING.

This trouble seems indistinguishable from the ordinary softening of overripe fruit, and but for its occurrence upon specimens just turning colour one would have thought it was nothing but the natural ripening process. Affected fruit appear to soften in patches that exhibit an almost imperceptible change in colour and in the transparency of the skin. To this condition were attributed certain qualities in the fruit injurious to the consumers. This, in fact, was the only aspect of the matter immediately important to the grower in the present instance, who was withholding the sale practically of his entire crop—valued at £200—on account of several cases of illness reported to be due to his fruit. Experiments with typically affected fruit indicated that there was little fear of such disorders arising from the tomatoes as he marketed them. He was consequently advised by telegram to proceed at once with the sale of the fruit.

The softening in patches of ripening fruit may be merely the incipient stages of the circular-white-patch condition, which was found much more abundant throughout the crop. Further observations in this direction will be made.

Cultivation given to the lucerne at Ruakura during the latter part of January had a wonderful effect on the succeeding crop. Rye-grass, Yorkshire fog, catsear, and sorrel, which had constituted the principal weeds in the lucerne, were almost absent from this growth. The cultivating operation was carried out under ideal weather-conditions, a hot sun rapidly withering up the weeds after they had been dragged out by the cultivator and harrows.

LUCERNE - CULTIVATION.

A. McTAGGART, M.S.A., Agriculturist.

THE experience of Australia and of other parts of the world in the growing of lucerne emphasizes the importance of systematic cultivation. The best growers regard good cultivation as essential to success with this greatest of forage crops. The lucerne-plant penetrates deeply into the soil in a perpendicular manner, hence

RENOVATING A LUCERNE-FIELD IN AUSTRALIA WITH THE SUNSHINE RIGID-TINE CULTIVATOR.

repeated and deep cultivation with the proper implement cannot injure the crop, but rather, on the contrary, it greatly improves it. Such tillage, while creating ideal conditions for the thriving of the lucerne-plant, effectively removes weeds and all other growths of a shallow-rooting nature. Clean fields ensure an unchecked growth of every stalk, while the unrestricted penetration of light and sunshine naturally promotes a vigorous development of succulent leaf. The stirring of the soil by use of the cultivator admits air, and this bestirs to renewed activity the minute beneficial bacteria, which are of primary importance to fertility.

Knowing the importance of the cultivation of lucerne, the irrigation authorities of the State of Victoria conducted at Tongala a competition with a view to ascertaining which implement gave the best practical results. The Sunshine rigid-tine cultivator was awarded first place. The points most considered by the judges who made the award were lightness of draught, thoroughness of soil-cultivation, destruction of weeds, simplicity of structure, and least injury to crop. The twelve-tine size cultivator of this make that was used in the trials was easily drawn by three medium draughts; it cut out practically all trefoil, grass, and weeds without unduly damaging the lucerne; and it stirred the soil throughly to a fine tilth.

During a visit paid recently to Australia by the writer he inspected the Central Research Farm at Werribee, near Melbourne. While there his attention was drawn to this useful implement, which gave excellent results in the renovating of lucerne, particularly in soils inclined to bake — soils characteristic of the Werribee Farm.

The Sunshine rigid-tine cultivator is manufactured at Sunshine, Melbourne, by the firm of H. G. Mackay, maker of the famous Sunshine harvester. The cultivator is made in various sizes, or in such a manner that it can be extended, thus meeting the needs of all farmers, large and small. Built mainly of steel, it possesses great structural strength without being heavy or awkward. The main beam, which ensures the accurate working of all the other parts, is of stout section steel. To this the reversible stub axles are bolted, and also the front frame of angle steel, which bears the pull of the tines. So strong is the principle of construction employed that there is no possibility of important details twisting or sagging whilst at work. Since the tines serve such an important function in the cultivator, they are made of spring steel, wrought to a hollow shape, and tempered, enabling them to withstand both direct and side strains to an exceptional degree. The tines used for renovating lucerne can readily be removed, and replaced by duck-foot points for the effective cultivation of fallow.

The following are the prices asked in Australia for the implement in its various sizes: Sixteen tines, 6 ft. 3 in. wide, £22 10s.; twelve tines, 5 ft. wide, £19 10s.; ten tines, 3 ft. 10 in. wide, £13 10s.; eight tines, 3 ft. 4 in. wide, £12.

As lucerne is a crop which bids fair to play an important part in the agricultural economy of New Zealand, and as the keeping of the crop clean is perhaps the chief problem connected with its establishment in this country, the advent of a specially effective

cultivator (judging from the extensive trials to which the implement has been subjected in various parts of Australia) must be viewed with satisfaction. For autumn cultivation of lucerne, to provide a growth to carry it through the winter well; and again for early spring cultivation, to pulverize the soil and to destroy weeds, the introduction of such an implement at this season of the year would be timely.

FORAGE - CROPPING ON THE HAURAKI PLAINS.

THE crop of rye-corn and tares shown in the accompanying photograph was grown during the past season on Mr. Buchanan's farm at Pipiroa. The paddock of about 12 acres was sown in June, and the crop made marvellous growth during the winter months,

THE CROP OF RYE-CORN AND TARES.

attaining a height of fully 6 ft. In November the crop was cut and made into stack ensilage (on Mr. Dibble's advice), being estimated to have produced from 80 to 100 tons of that fodder. Five years ago this part of the Hauraki Plains was considered useless, and grew little except saltweed. Systematic draining—open and mole—has transformed the home of the wild duck into rich pastures, which even now are hardly to be beaten in the Province of Auckland, and in a few years will be second to none in the Dominion.—*C. E. McPhee, Fields Inspector, Thames.*

THE FRUIT INDUSTRY.

VARIETIES FOR EXPORT AND LOCAL MARKETS.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

For a number of years past substantial areas planted in fruit-trees have been annually added to those already existing in the Dominion, but a special impetus was given to orchard planting about the year 1909, when a large area of comparatively cheap land in the Nelson District was made available for orcharding purposes. Subsequently other districts adopted a similar scheme to that introduced in the Nelson District for the control and management of new orchard properties, with the result that from 2,000 to 3,000 acres of new orchards have been planted yearly.

Present indications are that this rate of increase is likely to continue for some time, and some idea of the annual increase in the fruit-production of the Dominion as a result can be gathered from the following: 3,000 acres of land planted in fruit-trees at the rate of 150 trees per acre equals 450,000 trees. Calculating the yield when the trees are in full bearing at the modest estimate of two 1-bushel cases per tree, gives a total increase of 900,000 cases of fruit annually. Now, allowing for failures, which are more or less sure to take place in this as well as any other industry of the kind, by halving this total we still have 450,000 additional cases of fruit to be dealt with every year. Multiply this by 7, and we have a total of 3,150,000 cases, the trees for the production of which have been planted during the last seven years.

We shall not, of course, feel the effect of this increase for several years to come, but the trees planted in 1909 are now coming into bearing, and should in a year or two be producing fruit at the rate mentioned. From that time onward an annual increase equal to the above can be expected so long as the area is being extended at the present rate.

An industry making such rapid strides as this is worthy of and must require, very careful management from a Dominion point of view. The problems that necessarily have to be faced should be taken in hand and dealt with as early as possible, and the business thoroughly well organized and placed on a sound footing in ample time to cope with the increased trade. Such problems no doubt will be found to be many and varied; but one

which appears to be of the utmost importance at the present time is the appointment of a New Zealand representative to visit and report upon the various markets of the world likely to be of value to the fruit industry of New Zealand, such report to cover the means and cost of transit, season of the year when fruit is required, and the capacity of the market at a price which will allow a profitable margin over and above the cost of production. This is not only necessary in order to provide for a reliable outlet for our fruit in the future, but also to ascertain approximately to what extent the present rate of orchard-extension can be continued with safety.

One very important step has been made in the direction of more efficient organization of the industry in the form of a joint conference of representatives of fruitgrowers, nurserymen, and officers of the Department, held in Wellington during the latter end of last month, for the purpose of considering the best varieties of the different classes of fruits to recommend for extensive planting to serve the possible markets of the future.

Up to the present our most extensive market has been that of New Zealand itself. During the last few seasons this market has been greatly assisted and regulated by a limited export trade carried on with South America, but judging by the figures previously mentioned it is quite obvious that this cannot long continue. In a few years neither our local market nor the South American market, even though much more fully exploited than at present, will be able to absorb the amount of fruit then available. No doubt when this time arrives we shall be compelled to look to the Northern Hemisphere to provide the markets required. This means that past and present conditions will possibly be affected. Varieties considered suitable for the markets available in the past may not profitably serve the markets of the future.

This aspect of the fruit industry has for some considerable time exercised the minds of the officers of the Department, many of whom have been advising against the overplanting of varieties unsuited for the European markets. It was recently considered that something more definite in the way of a warning and guidance should be issued, and a conference of Orchard Instructors representing the various districts of the Dominion was held last September, with a view to adopting lists of varieties of apples and pears to recommend for future planting. The lists recommended by the Conference, covering apples and pears for export to the markets of the Northern Hemisphere, South America, and for local purposes, were duly issued.

The matter was again brought up at the recent Nurserymen's Conference as a result of a paper read by Mr. D. Hay, of Auck-

land, on the subject of the elimination of unnecessary varieties from general nursery stock. During the discussion which followed the reading of this valuable paper the work of the Orchard Instructors' Conference was mentioned, and the lists of varieties discussed, and practically approved. In order to strengthen the hands of the Department, however, and in recognition of the importance of the question not only to the fruitgrower but to the nurseryman, it was ultimately arranged that a joint conference should be held to further consider the question. The Conference was held at Wellington at the end of February, the following representatives being present :—

Fruitgrowers: Mr. J. Longton (Secretary, New Zealand Fruitgrowers' Federation, Christchurch), Mr. J. G. Kay (Auckland), Mr. A. Moore (Hastings), Mr. A. P. Allport (Nelson), Mr. S. I. Fitch (Christchurch).

Nurserymen: Mr. G. A. Green (Secretary, New Zealand Federation of Nurserymen, Auckland), Mr. R. T. Morrison (Auckland), Mr. Thomas Horton (Hastings), Mr. T. Waugh (Lower Hutt), and Mr. C. F. Ivory (Rangiora).

Departmental Officers: Mr. T. W. Kirk (Director of the Horticulture Division), Mr. J. A. Campbell (Assistant Director of the Horticulture Division), Mr. J. W. Collard (Orchard Instructor, Whangarei), Mr. A. B. Mansfield (Orchard Instructor, Auckland), Mr. W. J. Courtier (Orchard Instructor, Canterbury), and Mr. W. T. Goodwin (Orchard Instructor, Otago).

During the deliberations much useful work was accomplished. The various aspects of the fruitgrowing industry and the markets relating thereto were fully considered, also the suitability of the various varieties of fruits recommended for future planting.

The Conference wishes to point out to all intending planters of fruit-trees the great change that must necessarily take place in regard to the marketing of New Zealand fruit long before any trees planted from now onward come into bearing. By the time such trees come into bearing there is no doubt that the markets of the Northern Hemisphere will be providing our principal outlet. Any person intending to plant fruit-trees extensively, particularly apples, would therefore be well advised to take this factor into consideration and plant accordingly.

As a guide to planters it should be generally known that the months of March, April, May, and the early part of June cover the period which offers the best opportunities for the satisfactory disposal of New Zealand fruit on the markets of the Northern Hemisphere; also that it takes seven weeks from the date of

shipment to land New Zealand fruit on the English markets. Considering these matters it is inadvisable to plant too extensively for the English markets any variety coming to maturity later than the middle of April. On this account the Conference is desirous of issuing a warning against very extensive planting of the Sturmer Pippin. In regard to this apple, its many excellent qualities influenced the Conference in retaining it on the export lists, but the majority of delegates were clearly of the opinion that it comes in rather on the late side to warrant its extensive cultivation for the European markets.

Again, the Conference wishes to point out that the early and mid-season varieties should be more largely planted than in the past, as such fruit can be landed when the markets of the Northern Hemisphere are practically bare of apples, thus affording better opportunities of a ready sale.

The aim of the conference was to keep the lists of varieties recommended for future planting as low as practicable, at the same time selecting those varieties most suited for general planting throughout the Dominion; but slight allowance had necessarily to be made to suit the conditions of the various districts.

The following subjects were dealt with, and varieties recommended to suit:—

(1.) Apples and pears for the Northern Hemisphere markets.
(2.) Apples for South American markets.
(3.) Apples, pears, peaches, nectarines, plums, prunes, and apricots for local markets.

The varieties recommended are as follows:—

NORTHERN HEMISPHERE.

DOMINION LIST OF APPLES.

Gravenstein.	Delicious.
Golden Pippin.	Dunn's (Monroe's) Favourite.
Scarlet Pearmain.	Cleopatra.
Worcester Pearmain.	Rome Beauty.
Cox's Orange Pippin.	Statesman.
Jonathan.	Sturmer.

The representatives of the various districts selected from the Dominion list of varieties recommended for the markets of the Northern Hemisphere those varieties best suited for their particular districts, as follows:—

Auckland District.

Gravenstein.	Delicious.
Golden Pippin.	Dunn's (Monroe's) Favourite.
Scarlet Pearmain.	Rome Beauty.
Cox's Orange Pippin.	Sturmer.
Jonathan.	

Hawke's Bay District.

Worcester Pearmain.
Cox's Orange Pippin.
Jonathan.
Delicious.
Dunn's (Monroe's) Favourite.
Sturmer.

Wairarapa and Wellington District.

Worcester Pearmain.
Cox's Orange Pippin.
Jonathan.
Delicious.
Dunn's (Monroe's) Favourite.
Sturmer.

Canterbury District.

Worcester Pearmain.
Cox's Orange Pippin.
Jonathan.
Delicious.
Dunn's (Monroe's) Favourite.
Rome Beauty.
Sturmer.

Nelson District.

Worcester Pearmain.
Cox's Orange Pippin.
Jonathan.
Delicious.
Dunn's (Monroe's) Favourite.
Sturmer.

Otago District.

Gravenstein.
Worcester Pearmain.
Cox's Orange Pippin.
Jonathan.
Cleopatra.
Rome Beauty.
Statesman.
Sturmer.

It is gratifying to note that the twelve varieties of apples selected by the Conference were included in the fourteen varieties previously selected by the Orchard Instructors' Conference.

DOMINION LIST OF PEARS.

Beurre Bosc.
Beurre Capiaumont.
Beurre Clairgeau.
Beurre d'Anjou.
Beurre Diel.
Doyenne du Comice.
Directeur Hardy.
Durondeau.
Giblin's Nelis.
Glou Morceau.
Josephine de Malines.
Marie Louise.
P. Barry.
Twyford's Monarch.
Winter Cole.
Winter Nelis.

SOUTH AMERICA.

DOMINION LIST OF APPLES.

Cox's Orange Pippin.
Jonathan.
Delicious.
Dunn's (Monroe's) Favourite.
London Pippin (Five-crown).
Lord Wolseley.
Cleopatra.
Yellow Newtown Pippin.
Rome Beauty.
Statesman.
Sturmer.
Dougherty.

LOCAL MARKETS.

DOMINION LIST OF APPLES.

Beauty of Bath.
Red Astrakhan.
Lord Suffield.
Gravenstein.
Golden Pippin.
Scarlet Pearmain.
Worcester Pearmain.
Cox's Orange Pippin.
Alfriston.
Jonathan.
Reinette du Canada.
Delicious.
Dunn's (Monroe's) Favourite.
London Pippin.
Lord Wolseley.
Cleopatra.
Yellow Newtown Pippin.
Rome Beauty.
Statesman.
Sturmer.
Dougherty.
Ballarat.

DOMINION LIST OF PEARS.

The Conference carried a resolution warning intending planters against very extensive planting of any variety of pears for local markets, particularly the early and mid-season varieties. Planting for the local markets should be mainly confined to the later keeping varieties, selected to suit the locality, from the following :—

Beurre Bosc.
Twyford's Monarch.
Winter Cole.
Winter Nelis.
Josephine de Malines.
L'Inconnue.

The following varieties may also be grown with satisfaction in localities having canning-facilities :—

Williams's Bon Chrétien.
Keiffer's Hybrid.

Should, however, a rotation of pears be desired, the following should prove satisfactory :—

Williams's Bon Chrétien.
Louise Bonne of Jersey.
Conference.
Beurre Diel.
Beurre Bosc.
Doyenne du Comice.
Winter Cole.
Winter Nelis.
P. Barry.
L'Inconnue.

DOMINION LIST OF STONE-FRUITS.

PEACHES.

D denotes dessert; C, canning; W, white flesh; Y, yellow flesh; F, freestone; Cl, clingstone; and S.Cl, semi-clingstone.

Early Varieties.	
Sneed	D.W.F.
Brig's Red May	D.W.F.
High's Early Canada	D.W. S.Cl.
Admiral Dewey	D.Y.F.
Second-early Varieties.	
Hales	D.W.F.
Wiggins	D.W.F.
Mamie Ross	D.W.F.
Carman	D.C.W. S.Cl.
Delicious	D.Y.F.
Peregrine	D.W.F.
Noblesse	D.W.F.
Mid-season Varieties.	
Royal	D.W.Cl.
Surecrop	B.W. S.Cl.
Elberta	C.Y.F.
Mid-season Varieties—contd.	
Kalamazoo	D.C.Y.F.
Up-to-date	D.C.Y.F.
Kia Ora	D.C.Y.F.
Late Mid-season Varieties.	
Paragon	D.C.Y.Cl.
Muir	D.C.Y.Cl.
Sea Eagle	D.W.F.
Sea Eagle Improved	D.W.F.
Wheatland	D.C.Y.F.
Prizetaker	D.W.F.
Late Varieties.	
Lippiatt's Late Red	D.W.Cl.
Golden Queen	D.C.Y.Cl.
Solway	C.Y.F.
James's Cling	D.C.Y.Cl.

NECTARINES.

Ansenne.
Early Rivers.
Goldmine.

PLUMS (ENGLISH).

Angelina Burdett.
Coe's Golden Drop.
Damson-Russian.
Diamond.
Early Orleans.
Early Rivers.
Evans's Early.
Giant.
Grand Duke.
Greengage.
Jefferson.
Kirks.
Magnum Bonum (Yellow).
Monarch.
Pond's Seedling.
President.
Takapuna Drop.

PLUMS (JAPANESE).

Burbank.
October Purple.
Ogon.
Satsuma.
Sharp's Early.
Wickson.
Wright's Early.

PRUNES.

Fellenberg.
Golden Prune.
Petite d'Agen.
Tragedy.

APRICOTS.

Boulton.
Hemskirk.
Mansfield's Seedling.
Moorpark.
Newcastle.
Oullin's Early.
Royal.
Roxburgh Large Red.

VARIETIES FOR FURTHER TESTING.

The Conference was of the opinion that the following varieties of the various classes of fruits were worthy of further testing, and recommended that this be done at the Department's horticultural stations :—

APPLES.

Charles Ross.
Cliff's Seedling.
Diadem.
Glengyle's Red.
Goldbridge.
Grannie Smith.
Houblon.
King David.
Marian Red.
McIntosh Red.
McLiver's Winesap.
New Gold Pearmain.
Patoka.
Premier.
Senator.
Shorland Queen.
Stayman's Winesap.
Winter Banana.

NECTARINES.

Brookdale.
Late Jewel.
Lily Baltet.
Mrs. Dr. Chisholm.
Nelson.

PLUMS (JAPANESE).

Ballena.
Formosa.
Gariota.
Hermosillo.
Maynard.
Ngata.
Rutland Plumcott.
Santa Rosa.

PRUNES.

Imperial d'Ephenuse.
Splendour.

APRICOTS.

Blenheim.	Pringle.
Gooley.	Riverside.
Harris.	Smyrna.
Louise Lette.	Tilton.
Precose de Wunnie.	

With regard to all the foregoing Dominion lists, the Conference wished to advise intending commercial planters to consult with the Orchard Instructor or local nurserymen of the district as to the varieties most suitable for planting before placing their orders. Intending planters of domestic orchards are advised to apply to the same sources for local information.

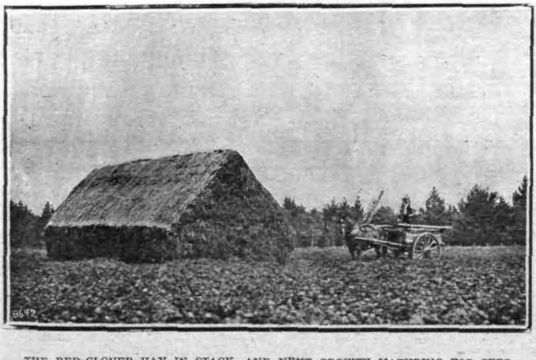
RED CLOVER AT RUAKURA.

THE 11-acre field of red clover at the Ruakura Farm of Instruction, illustrated opposite, was laid down in conjunction with a wheat crop. The wheat was put in early in September, 1914. About a month later the clover was sown at the rate of 15 lb. per acre, the seed being lightly harrowed in. Fertilizers consisting of 3 cwt. basic superphosphate and 1 cwt. bonedust per acre were used for the combined crop. The wheat crop (Bob's variety) was harvested in January, 1915, yielding 45 bushels per acre. The clover then came away extremely well. During April a portion of the crop was cut and fed out to stock, the remainder being fed off with wethers. On the 1st September the field was shut up for hay, and cut in the last week of November, giving a yield of about 2¼ tons per acre. The field was subsequently shut up again, and the clover made another heavy growth, which has been allowed to mature seed. The crop is being harvested this month and promises a good yield on threshing. The first photograph shows the crop at the end of October coming on for hay. In the second picture the resultant haystack is seen standing in the crop maturing for seed.

The ostriches raised at the Yanco Experimental Farm, New South Wales, are kept on lucerne runs, and feed almost entirely on lucerne.

Swedish gorse-vetches at Ruakura this season were badly attacked by caterpillars. The grubs did not touch the leaves, but stripped the pods of almost every seed. Scotch tares yielded very heavily, not being touched by caterpillars, although growing only a few yards distant from the field of Swedish gorse-vetches.

RED CLOVER AT RUAKURA COMING ON FOR HAY.



THE RED-CLOVER HAY IN STACK, AND NEXT GROWTH MATURING FOR SEED.

RIPE-ROT OF STONE-FRUITS.*

A. BAILEY MANSFIELD, Orchard Instructor, Auckland.

QUITE a number of peaches and nectarines affected with ripe-rot were sent in to the Department's Auckland office for examination during the latter portion of January and through the month of February. In most of the Auckland peach-growing districts the loss of fruit from ripe-rot has been considerable.

Ripe and partially ripe fruits of the peach and nectarine affected by this disease show a yellowish covering of dust-like powder mixed

PEACHES AFFECTED WITH RIPE-ROT.
Centre fruit showing characteristic white mould and spores of the fungus.

with a bluish tint. If observed in an earlier stage the area affected will be whitish instead of bluish; later the whole fruit becomes either a rotten mass or small and shrivelled, and the powdery substance occupies a larger area. The rotting of the fruit is caused by a fungus (*Monilia fructigena*) allied to the common blue mould which forms upon bread, and the powdery mass

* In New Zealand this disease is frequently termed "brown-rot." More correctly, however, and for the sake of distinction, the latter name should be confined to a similar disease of the apple and other pip-fruits.

is composed of spores. The white coating upon the fruit is the mycelium, the vegetative part which bears the same relation to the fungus that the roots do to a higher plant. The mycelium grows into and through the tissue of the fruit, and after development the fungus spores are formed. These are visible as the bluish powder or mould. The spores, which are thin-walled and oval in outline, are joined together in bead-like strings, and as they become matured break off, blow away, and fall upon the fruit. Given the right climatic conditions they start to grow rapidly. A slender tube is sent out, continues to lengthen, and, finding entrance into the fruit, it grows and develops, and spores are again produced. The disease frequently gains access to the fruit through a puncture in the skin—even a bruise is sufficient. Usually it is first seen in peaches or nectarines that are in direct contact with each other, and it spreads most rapidly during moist, warm weather.

NECTARINE AFFECTED WITH RIPE-ROT.

Although most of the commercial fruitgrowers recognize this form of fungus and are aware of its destructiveness, yet few are familiar with its history. After a season when ripe-rot has been bad a serious reinfection may be expected the following spring, because the disease is carried over in the mummied fruit left on the trees, or by infected fruits and leaves under the trees. Little can be done to cure the disease, but much good can be accomplished preventively by spraying with lime-sulphur solution in the early summer and whilst the fruit is developing on the tree. This will prevent infection of fruits not already affected. Lime-sulphur may be used in the proportion of 1 part of lime-sulphur solution to 100 to 125 parts of water. In the winter the trees should be thoroughly sprayed with sulphate of copper (pure bluestone) in the proportion of 1 lb. of bluestone to 10 gallons of water. The early spring spraying with either lime-sulphur solution or Bordeaux mixture should not be neglected. In pruning the trees all mummied fruits should be cut off.

When marketing the fruit during the season care should be exercised in picking to avoid bruising and puncturing the skin, as the disease will develop during transportation to the markets. Quite a lot of fruit has arrived on the market affected with ripe-rot. Care should also be taken in the packing-house to remove all diseased fruit, otherwise the spores may find lodgment in the building and continue to affect every load brought into it. Thorough ventilation will assist materially in checking the spread of the disease. Cull fruit should not be allowed to remain about to decay, but should be destroyed, preferably by burning.

CO-OPERATIVE HANDLING OF GRAIN IN CANADA.

ONE of the most successful farmers' co-operative enterprises in the progressive Canadian province of Saskatchewan is that of the Co-operative Elevator Company, which was established in 1911 upon the recommendation of a Royal Commission appointed in 1910 to inquire into matters affecting the grain trade. The company was formed to enable the farmers to free themselves from what they asserted to be a monopoly exercised by grain-dealers, combinations of grain-dealers, and private elevator companies in Western Canada. It has power "to construct, acquire, maintain, and operate grain-elevators in Saskatchewan; to buy and sell grain; and generally to do all things incidental to the production, storing, and marketing of grain." The amount of the share capital is not fixed: the shares have a nominal value of $50, and no one may hold more than twenty shares. The general management is in the hands of a Board of nine directors, and each elevator acquired or built by the company has a local board of management consisting of five shareholders. Upon certain conditions the Government advances a large part of the capital required for each local elevator, loans from Government being repayable in twenty equal annual instalments, with interest at 5 per cent. Any number of shareholders in a particular locality may request the company to buy one of the elevators at the local forwarding point or build a new one, but before taking any action the board of directors must be satisfied that the amount of shares held by the supporters of the proposed local elevator is at least equal to the value of the proposed elevator; that 15 per cent. of the amount of such shares has been paid up; and that the aggregate annual crop acreage of the said shareholders represents a proportion of not less than 2,000 acres for each 10,000 bushels of elevator capacity asked for. The growth of the company has been rapid. Between 1911–12 and 1914–15 the following increases took place: Number of shareholders, from 2,597 to 14,922; number of elevators, 46 to 215; grain handled through elevators, 3,261,000 to 12,344,000 bushels; grain handled on commission, nil to 11,000,000 bushels. The annual report of the company for the year ending the 31st July, 1914, shows that the authorized capital at the end of the year was $2,000,000, the subscribed capital $1,911,800, the paid-up capital $382,461, and the profit on the year's working $285,181.

During dry weather this summer at Ruakura weaner calves have been turned on to a break of lucerne, and then into a pasture-field largely composed of *Paspalum dilatatum*. The growth of paspalum on some of the poor swamp land of the farm has been remarkable this summer.

PHOSPHATES AND LIME.

SOME FARMERS' EXPERIENCE.

B. C. ASTON, F.I.C., Chemist to the Department.

IN previous issues of the *Journal* I have endeavoured to show that New Zealand soils are usually so deficient in lime that phosphates, especially superphosphate (which is acid in reaction), benefit by being mixed with either lime or some phosphate containing lime in excess, such as basic slag or bonedust, or even by using basic slag by itself. The following selection of extracts from letters received from farmers in connection with the advice given to them by the writer (through the Fields Division) regarding the manurial treatment of their land contains matter of general interest and instruction bearing on this subject :—

A Stirling (Otago) farmer reports :—

The manurial treatment advised—namely, 2 tons of lime per acre, with a liberal dressing of guano—I have found very beneficial for this class of land. On ground that I treated according to your directions I grew swede turnips up to 25 lb. in weight; on the same ground that was not treated with lime, &c., there were none that would weigh more than 6 lb. The same result was noticeable on all other crops treated.

A farmer at Awarua Plains (Southland) writes :—

Regarding advice as to manurial treatment of soil for grass: The paddock treated was 15 acres. It was ploughed out of oat-stubble at the end of May and early June, cultivated and rolled 10th to 16th October, limed with 9 cwt. burnt crushed lime on the 17th. Owing to rain it was not harrowed until the 20th. The grass, with 2 lb. of rape, was sown on the 3rd and 4th November and harrowed immediately (10 cwt. grass-manure sown with grass). Twenty cows were turned in on the 23rd January, 1914. It grazed fairly well all summer, but in winter had a red unhealthy appearance. It was top-dressed with 2 cwt. basic slag on the 26th July, with simply marvellous results. Twenty cows were put on on the 10th October, and although they were on it almost continually in the daytime the growth of clover was so luxuriant that we fenced off about 5 acres and cut it for hay. It was fenced off on the 11th January and cut on the 15th February, giving, although the weather was very unfavourable, about 2 tons of hay. I think it worthy of mention that one width of the drill was left un-top-dressed, and the rest of the paddock (1 acre) was top-dressed with kainit, 2 cwt. I could see no difference between the untreated strip and that on which the kainit was put—at least not during the summer. I can see a difference now, but hardly traceable. The part treated with kainit was like a saved paddock, the stock not touching it till late in the season. I think I am within the mark when I say the ground treated by your advice will carry three cows for one on untreated ground. You advised 1 ton lime and 5 cwt. slag. Had I used these quantities no doubt the result would be still more marked, but I am well pleased with the results with the lesser quantities, and am very grateful to the Department for the advice.

The following is the report of a farmer at Lichfield, Waikato :—

With respect to slag and superphosphate on pumice soil: Consequent on your statement that basic superphosphate was but ordinary super. with 15 per

cent. of lime added, coupled with the fact that our experimental use of lime had been absolutely resultless, we decided not to use basic super. The failure to do so experimentally was perhaps a pity. We have, however, as advised by you, used the mixture of 1 cwt. superphosphate and 2 cwt. basic slag per acre, and the results would seem to prove that the value of both is increased by the mixing. In fact, in some cases slag seems of little use unless applied in conjunction with super.

In April, 1913 (before receiving advice), we applied the two separately, but in equal quantities, as a top-dressing. The spot chosen was a gully-bottom that was growing tussock, fog, and white clover. By close inspection the clover was just discernible among the fog. On the coming of spring the result of the super. dressing was startling. The white clover took complete possession, the fog disappeared, and by summer there was as fine a showing of leaf and seed-head as one could desire; whereas the only result of the slag dressing was that the grass and clover both became a slightly livelier green, no increase in growth beyond the ordinary being noticeable. It was observed, however, that when the stock had access to it they preferred that portion dressed with slag to that which had received no dressing at all, though certainly not in preference to the super.-dressed portion.

For a comparative illustration of the results of the slag-and-super. mixture as compared with the super. alone I will report from an experimental plot of grasses and clovers established by my brother on the 8th October, 1913. Although the clovers in the super.-dressed portion of the plot were quick to establish and continuous in growth, it was noticeable that in the slag-and-super. portion they had slightly the advantage from the first—an advantage which they have distinctly maintained to the present (May, 1915). The difference was even more marked with the grasses. In fact, the grasses in the super.-dressed plot did little better than in the unmanured part alongside. The slag and super., however, distinctly encouraged the grasses, and was only beaten by the rye in the blood-and-bone portion. I might add here that the clovers in that portion were comparatively a failure.

With respect to slag and super. for turnips, no such careful experiments have been carried out as would give valuable data. Our experimental plot in this crop was quite resultless. After an elaborate system of manuring no one section showed better than another, or little better than the unmanured section. It was, however, our first trial with turnips (swedes), and it taught us that the best and most necessary preparation for any manuring on pumice soil is the thorough working of the soil, concluded with a final firm rolling. We have this year a portion of a swede paddock sown with slag and super., and a portion sown with super. and Island phosphate. So far there is no visible difference in growth, but it was distinctly seen that germination in the slag-and-super. portion was quickest and best.

A farmer near Palmerston North writes :—

I consider I had good results from the fruit-trees I treated as you recommended with 1 lb. each bonedust, superphosphate, and seed gypsum, and ½ lb. sulphate of potash, forked in round each fair-sized tree. I used it on peach-trees only, and the fruit was well grown, and the trees put on more growth and showed a healthier appearance. The early peaches were well formed and of very good colour and quality; the late peaches were well formed, but not so good in colour, due, I think, to the cold dull weather in the autumn. I hope for better results in the coming season.

A farmer in Waiau (North Canterbury) reports as follows :—

For oats you advised drilling with the seed 1 cwt. of superphosphate and ¾ cwt. island phosphate per acre. This advice was acted on, and gave first-class returns. The mixture was drilled in with the seed on a field of 12 acres on the 16th September, 1912. In January, 1913, there was stacked from the field of oats three 6-yard stacks estimated to contain 40 tons of oat-sheaves. During May, 1913, these stacks were threshed, and yielded at the rate of 80 bushels per acre. For your information I wish to add that in 1911 this field produced one 6-yard stack, which threshed about 34 bushels to the acre; this crop was grown without manure. On the 25th September, 1914, you advised the use of superphosphate, bonedust, and basic slag in equal parts for rape and turnips. This advice has been followed and has given the greatest satisfaction during the past dry summer.

The following report is from an Opuatia (Waikato) farmer :—

Regarding manurial treatment recommended by your Department: I top-dressed with slag as advised, applying 6 cwt. per acre, except for a small portion which received 2½ cwt. per acre, and another portion unmanured. The manure was applied in January, 1914, and for some time I saw no result, partly on account of the dry weather. I am now (May, 1915) well satisfied with the result. That which had the 6 cwt. of slag came away splendidly in the spring, being of a much darker green than the 2½ cwt. piece, and thickening up much more quickly. Although it has had no more top-dressing since, it is a much better sole now than ever it was, and comes away well when closed up, excepting of course the unmanured piece, which shows signs of running out, and is much inferior in every way to the top-dressed grass and clovers. The 2½ cwt. piece does not grow as quickly as the 6 cwt. portion when the stock are off it, and the slag did not appear to act as quickly on it.

A Hukunui (Eketahuna) farmer writes :—

I might mention that I ploughed in a light crop of oats on scrub land and then sowed down in grass, using basic slag as you recommended, and the resulting sward of clover and grass is the best I have had.

BOARD OF AGRICULTURE.

The Board of Agriculture met in Wellington in February, all the members being present. The Minister of Agriculture (Hon. W. D. S. MacDonald) also attended the meeting.

The proposal of the Stratford Agricultural and Pastoral Association that a model dairy farm, run on commercial lines, should be established in Taranaki was discussed at length, and it was decided, before making any recommendation, to obtain fuller details, which could be considered at a later meeting.

In reference to the reported commandeering of a steamer which is used to convey phosphate rock from the Pacific islands to New Zealand, it was decided to point out to the Government that if this steamer was withdrawn from service it would mean that practically no phosphatic manures could be imported, as basic slag and superphosphate are increasingly difficult to obtain.

The Board was requested by the Hon. A. M. Myers (Minister of Munitions and Supplies) to appoint two of its members, one from each Island, to represent the Board at the conference of tanners, bootmakers, and producers to consider matters arising out of the embargo on the export of hides. Messrs. Hunt and Hall attended accordingly, and the former was appointed chairman of the committee set up to consider prices, &c.

The administration of the Noxious Weeds Act was discussed at some length. This is a matter upon which the Minister of Agriculture has asked for the recommendations of the Board. It was decided that a report embodying the Board's views on the subject should be prepared for presentation to the Minister.

The Board has received a lengthy and comprehensive statement from Professor L. H. Bailey, of Cornell University, New York, setting out the lines on which he considers rural education could best be conducted in New Zealand. It was decided to write thanking the professor for his report, although it is unlikely that much use can be made of it until after the war.

Attention was called to the spread of club-root in various parts of New Zealand, and it was decided to ask the Minister of Agriculture to have an investigation carried out as to the causes of this disease, and the means calculated to prevent its spread.

A number of letters in regard to forestry matters were dealt with.

The Board had a long consultation with the Minister regarding the Government experimental farms, and several matters of detail were fully discussed. It was finally decided that the matter be deferred until the Minister had had an opportunity of making a further personal inspection of these institutions. Other matters of a confidential nature were also discussed with the Minister.

HEMP AND TOW GRADING RETURNS.

FEBRUARY.

Hemp.—The total number of bales graded was 14,408, as compared with 8,477 or the corresponding month of last year, an increase of 5,931 bales. For the twelve nonths ending 29th February, 1916, the number of bales graded was 130,633, as :ompared with 88,069 for the previous twelve months, an increase of 42,564 bales.

Tow.—During the month 4,363 bales were dealt with, as compared with 2,174 or the corresponding month of last year, an increase of 2,189 bales. For the twelve nonths ending 29th February, 1916, the number of bales graded was 36,492, as :ompared with 25,666 for the previous twelve months, an increase of 10,826 bales.

Stripper-slips.—The number of bales graded was 828, as compared with 271 or the corresponding month of last year, an increase of 557 bales. For the twelve nonths ending 29th February, 1916, the number of bales graded was 5,330, as :ompared with 1,357 for the previous twelve months, an increase of 3,973 bales.

HEMP, TOW, AND STRIPPER-SLIPS GRADED THROUGHOUT THE DOMINION DURING THE MONTH OF FEBRUARY, 1916.

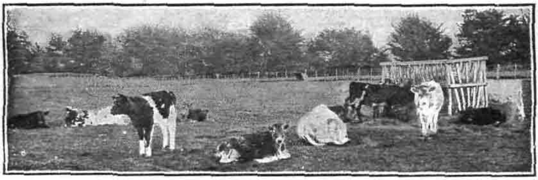
Hemp.

Port.	Superior.	Fine.	Good-fair.	Fair. High Point.	Fair. Low Point.	Common.	Rejected.	Condemned.	Total.
	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.
Auckland ..	..	..	220	974	893	223	73	..	2,383
Napier ..	..	..	..	..	..	..	..	..	..
Wairoa ..	..	..	..	..	..	..	..	..	..
Foxton ..	..	..	2,191	1,595	823	251	13	..	4,873
Wellington ..	..	..	697	2,776	1,768	183	14	..	5,438
Picton ..	..	34	118	19	..	..	..	..	171
Blenheim ..	..	..	..	32	..	..	..	..	32
Lyttelton ..	..	..	..	..	..	..	..	..	..
Dunedin ..	..	..	172	58	..	1	..	..	231
Bluff ..	..	..	165	962	153	..	..	..	1,280
Totals ..	..	34	3,563	6,416	3,637	658	100	..	14,408
Percentages of totals	..	0·23	24·73	44·53	25·24	4·57	0·70	..	..

Tow.

Port.	First Grade.	Second Grade.	Third Grade.	Condemned.	Total.
	Bales.	Bales.	Bales.	Bales.	Bales.
Auckland ..	..	276	552	159	987
Napier ..	..	..	..	..	..
Foxton ..	527	443	167	..	1,137
Wellington ..	214	611	331	75	1,231
Picton ..	44	26	..	..	70
Blenheim ..	22	..	..	..	22
Lyttelton ..	..	360	..	..	360
Dunedin ..	..	66	..	..	66
Bluff ..	..	184	267	39	490
Totals ..	807	1,966	1,317	273	4,363

Stripper-slips.—Auckland: Second grade, 14. Foxton: First grade, 41; cond grade, 361; condemned, 33. Wellington: First grade, 45; second ade, 253; condemned, 11. Blenheim: Second grade, 6. Dunedin: Second ade, 24. Bluff: Second grade, 29; condemned, 11.



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EUCALYPTS FOR FENCING-TIMBER.

SOME SUITABLE SPECIES AND HOW TO GROW THEM.

J. H. SIMMONDS.*

AMONGST the several things that are essential to successful farming and to the happiness of the farmer must be included good fences and well-hung gates. Bad fences waste the farmer's time, try his temper, spoil the habits of his stock, and bring him into conflict with his neighbours. All over New Zealand the question of obtaining an adequate supply of fencing-posts and gate-posts is becoming serious. In many districts the difficulty is already acute. The natural forests that have served us so well and so long have for over half a century been steadily receding before the progress of settlement,

* Rev. J. H. Simmonds, Principal of Wesley Training College, Auckland, is recognized as the first authority on eucalypts in New Zealand, and has wide knowledge of forestry matters generally.—EDITOR.

and now the remnants are everywhere menaced with irreparable exhaustion. The demand increases, the supply declines. Within twenty years from to-day hundreds of thousands of posts that are at present holding up our wires and gates will have fallen with decay. Whence shall we replace them? Within less than that period hundreds of new farms will be broken in and many old ones subdivided. Whence shall we obtain the posts for the necessary new fence-lines? The natural forests of Australia are being used up as our own have been, and the best we can hope for from them is to obtain for a limited number of years timber of receding quality at indefinitely advancing prices. If we look to ferro-concrete or iron, we may find when too late that the cost is prohibitive for general purposes.

The situation is grave, but, happily, there is a possible remedy. New Zealand is a country eminently suitable for growing timber-trees. We cannot profitably reproduce the indigenous trees, for the reason that they are too slow in coming to economic maturity; but there have been introduced numerous exotics, some of which have been found to grow with phenomenal rapidity to a large size in every province of the Dominion. The writer is at the present time using a fine lot of fencing-posts split out of *Cupressus macrocarpa* trees only eighteen years old. As most farmers now know, the timber of this familiar cypress is freely fissile, light to handle, and exceedingly durable, even the branches serving excellently as stakes or fencing-droppers. But in many situations this beautiful tree dies out before it reaches maturity, and at the best it attains only a moderate size. Thorny acacia (*Robinia pseudo-acacia*) yields very durable posts, but it is restricted in range and of small dimensions. Several of the wattles grow rapidly to a fair size, but their timber is not very durable. Larch (*Larix europaea*) is exceedingly valuable as a fencing-timber tree where it finds a congenial home; but its profitable range appears to be restricted to cold, damp uplands at high altitudes. These are, indeed, all good trees, and there are many others that could be mentioned and commended.

But it is in the great genus Eucalyptus that the majority of farmers will find trees adapted to their climatic conditions and at the same time capable of quickly yielding large quantities of timber that will prove durable when exposed to the weather or placed in contact with the ground. The relative superiority of the eucalypt as a farmer's timber-tree is so well put by a correspondent who writes from Racecourse Hill, Canterbury (Mr. H. A. Knight), that I cannot do better than quote his words: "I have," he says, "grown a great variety of trees here, and have come to the conclusion that,

for one's own lifetime, the gum is the cheapest, quickest, and best to grow on these plains for shelter, firewood, posts and stakes, rails, bridge-planks, &c., for use on the farm." It will interest the reader to know that Mr. Knight has 55 acres of eucalypts on his present property, and that there are 60 acres distributed on adjacent farms disposed of by him for closer settlement. The trees are in wide belts that effectually break the sweep of the winds; many of them are from 80 ft. to 100 ft. in height, and of proportionate diameter, and almost all of them are still growing vigorously. The total mass of timber is so great that there need be no shortage of either fencing-posts or firewood on those farms for a generation to come. Mr. Richard Reynolds, of Cambridge, Waikato, who has for the last fifteen or twenty years been cutting fencing-posts and firewood out of his eucalypt plantations at "Trecarne," is most emphatic and enthusiastic in his testimony to the superiority of the eucalypt over all other trees for the farmer's general purposes. He has had a great deal of both pine and gum sawn up, and both hold a high place in his appreciation, but the latter he regards as indispensable.

Further testimonies could easily be given, but they are unnecessary. The eucalypt has come to New Zealand to stay and to be the principal hardwood tree for all time. What is needed is not proof of this now evident truth, but information and advice that will enable a farmer in any particular locality to choose the species best suited for his climatic conditions and to go the best way about starting a plantation. It is a peculiarity of the genus Eucalyptus that it includes a very large number of valuable species. Some of these species are very sensitive to frost and can be grown only where the climatic conditions are mild and genial; others have a very wide range, and may be safely planted almost anywhere except close to the sea or on high mountains; and a few are even at their best on uplands where they have to endure not only severe frosts but occasional heavy falls of snow. There are probably at least fifty species that can be successfully grown as timber-yielders somewhere in this country, and it is hoped that when the proposed new Government forestry handbook is published most of them will be fully described. In this article it will be sufficient to describe and commend just a few of the hardiest and most rapid growers in each climatic group.

The ideal eucalypt for the farmer should be easily propagated; it should grow rapidly and vigorously to a large size; it should afford effective wind-break shelter and yield good firewood; its logs should be sufficiently fissile to be split with maul and wedges; and its timber when mature should last from fifteen to twenty or

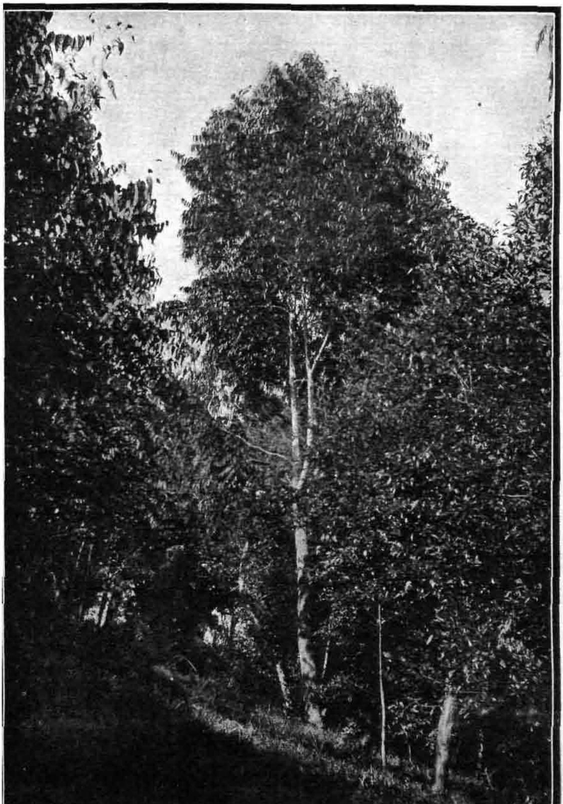
twenty-five years in contact with the ground. It will be a further great advantage if the timber is suitable for sawing up into boards and scantling. A Eucalyptus tree may be said to be mature when 75 per cent. of the timber in its stem has changed into what is technically called heart-wood. The number of years required for reaching this stage may vary from twenty-five to fifty or more according to the species and the nature of the soil upon which the trees are growing. In some species the distinction between sap-wood and heart-wood is not very obvious, but the experienced eye can usually detect the difference. In very old Eucalyptus trees there will sometimes be found a central core that has deteriorated or even decayed, but this does not detract from the value and durability of the heart-wood surrounding it. The sap-wood of eucalypts, like that of most other trees, quickly decays when placed in contact with the ground; the heart-wood of very many species is hard and more or less durable in any situation.

Individual species of eucalypts in the groups indicated will now be dealt with under the headings that follow.

SPECIES THAT REQUIRE WARM AND GENIAL CONDITIONS, SUCH AS ARE FOUND IN SHELTERED LOCALITIES NORTH OF WAIKATO AND EAST CAPE.

Eucalyptus saligna, Smith. — The specific name means "willow-like," but is not appropriate, as several other eucalypts are much more like willows. This tree is of erect habit, and rapidly develops a long clean shaft crowned with abundant handsome foliage. Its dead bark everywhere falls away, leaving a smooth greenish-white surface except at the base of the stem, where it sometimes persists in the form of thick, hard, non-fibrous plates or sheets. The leaves early pass the juvenile opposite stage, and thereafter may be described as stalked or petiolate, lance-shaped, of medium width, nearly equal-sided, of darker green on the upper than on the under surface, with numerous nearly parallel lateral veins and the intra-marginal vein near the edge. The umbel or flower-cluster has a flattened stalk and carries several flowers on short stalklets. The lid of the bud is conical, or is contracted into a slightly curved blunt apex, and stands just within the edge of the calyx-tube; the seed-case when mature is deep and much smaller at the base than at the rim; the valves while closed form a sunk pyramid within the rim, and when open project a little above it.

The timber, when of the best strain and mature, is of a pale-red colour; it is easily split or sawn, seasons well, is very durable



EUCALYPTS IN THE GROUNDS OF WESLEY TRAINING COLLEGE, AUCKLAND.
The centre tree is a specimen of *E. pilularis*, planted in 1906. The younger specimens showing on the left are *E. saligna*, planted in 1913.

in contact with the ground, and suitable for a wide range of general purposes. The seed germinates freely, and with reasonable care the plants can be safely removed from the nursery to their permanent home in the forest ground.

The species is indigenous to localities not very remote from the coast in eastern Australia, where it is greatly valued for the rapidity with which it grows to a useful size and for the high quality of its timber. It will attain its best in sheltered situations where the subsoil is free and moist but not wet. Specimens planted in the grounds of Wesley Training College on the Auckland Isthmus in 1912 have attained a height of 25 ft. and a diameter of 4 in. Older and larger specimens have been found doing well at Ruatangata, near Kamo. The species is very strongly commended by competent authorities in New South Wales.

Eucalyptus botryoides, Smith. — This tree usually carries a heavy mass of dark-green foliage; sometimes it has a tendency to become bent or inclined to one side, but under forest conditions it will develop a long straight bole. For a number of years the upper stem remains smooth, but as the tree matures both stem and larger branches become covered with a thick mass of deeply furrowed subfibrous dead bark. The leaves in the juvenile stage and subsequently are similar to those of *E. saligna*, but more shiny on the upper surface. The umbel has a flattened stalk with an indefinite number of sessile flowers. The buds are slightly angular and have a short pointed lid; the mature seed-case is deep-cup-shaped and usually angular at the base. A full umbel of mature fruits, we may suppose, suggested to the founder of the species the idea of a cluster of berries; hence the specific name, which means "grape-bunch-like." The resemblance to grapes is rather remote, but the suggestion is a slight aid to identification.

The timber from well-grown trees is red, hard, heavy, and very durable in any situation, reliable reports from Australia stating that posts split out of mature trees will easily last thirty years.

Though the natural habitat of the species is at low altitudes only a little removed from the sea in eastern Australia, numerous specimens have survived the frost and grown to a large size with us as far inland as Cambridge. Splendid specimens of younger age may be seen at Ruatangata, near Kamo, and at Wesley Training College. Settlers who wish to grow eucalypts on sandy lands near our northern coasts should find *E. botryoides* one of the best for their purposes; and generally within its climatic range the species is easily propagated either by sowing *in situ* or by transplanting, is hardy, vigorous, and of rapid growth.

Eucalyptus pilularis, Smith. — In an open situation the tree may become forked and branchy, but when surrounded by other trees of equal growth its stem will be free from branches and straight to a great height. The dead bark persists on the stem or part of the stem, and is then somewhat fibrous, like that of a stringybark. The juvenile or seedling leaves are lance-shaped, sessile, opposite, and often tinged with a rich purple colour; those of the adult tree are stalked or petiolate, graceful-lance-shaped, sometimes curved to one side and occasionally wavy, deep green on the upper surface and paler beneath; the lateral veins are numerous but not regularly parallel; the intra-marginal vein is distinctly removed from the edge of the leaf. The umbel has a flattened stalk with six to ten flowers on short stalklets. The lid of the bud is conical or pointed, and stands within the rim of the calyx-tube like an egg in egg-cup. The mature seed-case is of full medium size, and shaped like a nearly round bird's egg with one-third cut away; the rim is either flat or convex, and the points of the valves when open are below or slightly above it. The fruits are too large to be described as pilular, and it is supposed that the specific name was originally given to *E. piperita*, which has pilular fruits, and then transferred in error.

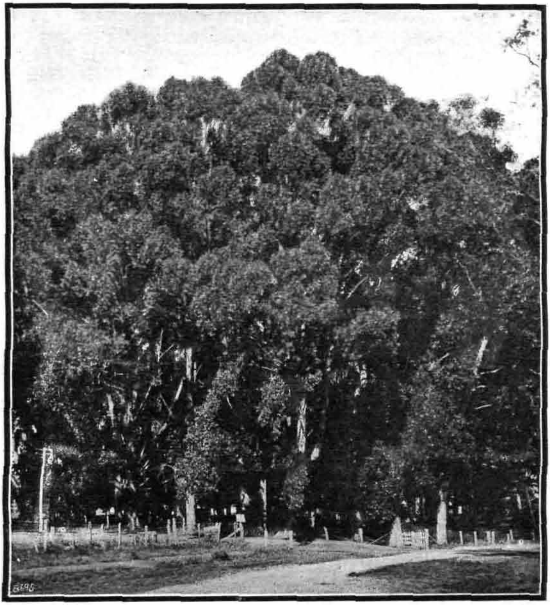
In their native habitat, eastern Australia, the trees now known to botany under the name of *E. pilularis* have often attained an immense height and diameter. The timber they yield is said to be excellent for either splitting or sawing, very durable in any situation, and especially suitable for fencing-posts; but of course the trees must be mature. Specimens planted perhaps forty-five years ago in the grounds of Mr. Robert Glasson, "Linwood," Runciman, and one or two others near Hobson Bay, Auckland, were long since large enough for the sawmill. Other large trees have been noted by the writer at Hakowai, near Napier. Numerous younger specimens are growing vigorously in several localities; one now nine years old in the grounds of Wesley Training College has a height of 47 ft. and a diameter of 11 in. 4 ft. from the ground.

Reports from New South Wales place this species in the first rank for general utility, and encourage extensive trial of it in our northern districts. Seed should be sown *in situ* or the plants worked in boxes, as the seedlings do not easily bear transplantation.

SPECIES WITH A RANGE INCLUDING ALL TEMPERATE AREAS IN THE NORTH ISLAND AND A FEW MILDER LOCALITIES IN THE SOUTH ISLAND.

Eucalyptus fastigata, Deane and Maiden. — This tree is of erect and very vigorous habit, the stem rapidly becoming tall and

strong, and the foliage being abundant and umbrageous. The stem and large branches are covered with persistent dead bark, which is distinctly fibrous, but not quite so tough as that of some other stringybarks. The leaves in the juvenile and adult stages are



EUCALYPTS ON THE RAILWAY RESERVE, PAPAKURA, AUCKLAND.
The large fibrous-barked trees are *E. fastigata*, from seed sown in 1884.

not very different. They are stalked, thin, lance-shaped, with gradual taper to the petiole and to the apex, and their two surfaces are of about equal green. The sloping or tapering shape of the leaf is an obvious character and, together with the shape of the bud, gave choice to the specific name *fastigata*. The umbels are produced in pairs in the axils of the leaves, the number of flowers

in each being indefinite. The lid of the bud is pointed but short. The mature seed-case is small, whip-top-shaped, and almost invariably three-celled; the three valves while closed form with the rising rim a smooth dome, and when open project above it.

The timber is pale in colour, and, being freely fissile, is easily converted into fencing-posts. It is also reported to be excellent for sawing into boards and scantling. How long fencing-posts split out of mature trees will last we have as yet not sufficient experience to say. Reports from New South Wales, together with the appearance of the fresh timber and of logs that have been for a considerable time lying on the ground exposed to the weather, seem to warrant an estimate of fifteen to twenty years or more. We must remember that the value of a timber is increased by the rapidity of its production, and in this respect *E. fastigata* certainly takes a very strong place. Trees on the railway reserve at Papakura, only thirty-two years old, have reached a height of 100 ft. and a diameter of 3 ft. to 4 ft. Younger but equally promising trees may be seen in the reserve just below the Cambridge Railway-station; and, again, on Mr. W. Corry's farm near Hinuera there are specimens 150 ft. in height, with tall straight shafts 3 ft. in diameter, and 60 ft. to 80 ft. to the first branch. The age in this last case has not yet been positively ascertained, but it may be put down at less than thirty-five years. Several large trees have also been noted in the grounds of Mr. B. Chambers, Havelock North, Hawke's Bay.

The species is one of those that, under favourable conditions, freely reproduce by natural distribution of the seed. When raised in the nursery the seedlings are at first rather tender, but when once established in the plantation the young trees soon become strongly frost-resistant. *E. fastigata* was formerly included as a variety under *E. regnans*, but its leaves, its persistent fibrous bark on stem and branches, and the rising rim of its fruit distinguish it from that species and entitle it to separate specific rank. Seed is still sometimes sold as *E. regnans*, and great care must be used to ensure getting the right tree. In ordering from Australia it may be well to specify "fibrous-barked" *Eucalyptus regnans*, known as variety *fastigata*.

Eucalyptus obliqua, L'Héritier. — Under favourable conditions the tree grows rapidly to a height of 80 ft. to 100 ft. and forms a long clean bole, but on poor land in an open situation it may be stocky and branching. The dead bark usually persists on both stem and branches, is thick and fibrous, and of a pale-grey colour. The leaves of the young plant are broader and shorter than those of the adult tree, but otherwise the two forms are not very

dissimilar. Both are stalked or petiolate and very unequal-sided, with the petiole oblique to the midrib. Those of the adult tree are long, curved to the weaker side, vertically suspended, and of equal dark green on the two surfaces. The specific name was suggested by the shape of the leaf, but, as the leaves of several other eucalypts are similarly unsymmetrical and oblique, it does not help much in identification. The umbel has numerous flowers, the common stalk being about ¾ in. long and the stalklets short. The bud is of a pale-yellow colour, has a short hemispherical lid, and tapers from the lid to the base or pedicel, after the manner of a club. The mature seed-case is of medium size, and takes the shape either of an egg with a small part of one end cut away or of a pear with the calyx end cut off. The valves are deeply sunk beneath the somewhat contracted rim.

The timber is of a pale-oak colour, is easily split, and excellent for sawing into boards and scantling. It is said that stout posts split out of mature trees will last fifteen years or more. The species, though indigenous to both Australia and Tasmania, is at its best in the south-eastern portion of the latter country, where the trees are so large and the natural crop so heavy that sawmills at work for many years still have abundant supplies before them. The Government pamphlet, "Tasmanian Forestry," states that *E. obliqua* is "esteemed as the most valuable general-purpose timber produced in Tasmania," and mentions wharf and bridge construction, house-building, railway-sleepers, and wood-paving amongst the uses to which it is applied. The output is immense, and the demand continuous.

The species is represented with us by many hundreds of specimens in various parts of the North Island and in Canterbury, many of which are large enough for the sawmill. A few trees in various localities have already been split or sawn up and utilized When once established *E. obliqua* reproduces itself very freely by natural distribution and germination of the seed; but the seedlings do not transplant well, and therefore in starting a plantation the seed should be sown *in situ*, or the plants worked in boxes or mossed. Seed should be obtained from the best trees in south-eastern Tasmania or from the best acclimatized trees in Canterbury.

Eucalyptus globulus, Labillardière. — The blue-green colour and angular stems of the young plant, the tall smooth bole and dark-green pendent leaves of the adult tree, the warty lid of the bud, are the large-ridged seed-case of this species are so familiar to leaf is in New Zealand that there is no need here to give a bud, gav description of the tree. It is important to remark, how-produced t the species is represented by two or three distinct

EUCALYPTUS FASTIGATA ON THE RAILWAY RESERVE AT PAPAKURA.
Grown from seed sown in 1884.

varieties in this country. A variety with very large single fruits is understood to be identical with the Tasmanian "blue-gum" that for over half a century has commanded such a high reputation as a timber-yielder. Another variety has three fruits of smaller size together on the same stalk. This is believed to have been derived from eastern Australia, and to be a tree of greatly inferior value as compared with the type from Tasmania. The question needs further investigation, but meantime planters of this species will do well to obtain their seed from first-class parent trees and preferably from those of Tasmanian origin.

The species has a very wide range in New Zealand, especially fine stands of it being now seen in certain parts of Canterbury, Otago, and even Southland; but in almost contiguous localities it has been killed out or hopelessly injured by frost or other cause. There is much to suggest that failure in these cases has been due in part to the planting of inferior and weaker strains, and that had seed been always obtained from the best Tasmanian stock, results would have been generally more satisfactory.

Sap-wood of *E. globulus*, like sap-wood of almost all other trees, will soon decay when exposed to the weather or placed in contact with the soil; but experienced men who have made careful tests are of opinion that fencing-posts of good size cut out of the best heart-wood will easily last sixteen years. Mr. B. Chambers, of Havelock North, Hawke's Bay, mentions a case on his farm where a blue-gum gate-post outlasted two mountain-totara posts in succession on the opposite side of the gateway. The timber of *E. globulus* is very compact and interlocked in texture. This greatly raises its value for many technical purposes, but makes a serious difficulty in converting large logs without powerful sawing machinery. Generally in future plantings the farmer will be wise to choose a tree whose timber is more freely fissile.

Eucalyptus Macarthuri, Deane and Maiden. — The tree is of erect habit, and under forest conditions develops a long clean bole with little taper; in open situations it sends out strong side branches and carries a wide-spreading mass of foliage very suitable for wind-break purposes. The dead bark persists on the stem and large branches, and becomes ultimately thick and deeply furrowed; it is of the soft type, with very short brittle fibres, and can be easily crushed in the hand. The leaves in the juvenile stage are sessile (*i.e.*, stalkless), opposite in pairs, broad at the base and acute towards the apex; as compared with the young-state leaves of *E. viminalis*, which they closely resemble, they are usually broader and perhaps a little thicker. The adult or mature-state

leaves are stalked, thin, alternate or scattered, rather narrow, a little curved to one side, and of about equal green on the two surfaces. Frequently both forms of leaf appear on the same tree, and occasionally juvenile leaves and fruit may be seen growing together on the same twig. The umbel has all its parts small and delicately formed. Normally it carries seven flowers, six placed laterally and one in the centre. The common stalk is short and the stalklets very short. The lid of the bud is low-domed with a minute central point. The seed-case is very small and hemispherical

EUCALYPTUS MACARTHURI FELLED FOR FENCING-POSTS AT "TRECARNE," CAMBRIDGE.

This splendidly grown tree was planted in 1875.

or semi-ovate in shape. When the valves open their points rise slightly above the rim.

From an early stage in their life the trees develop a large percentage of heart-wood, which is of a pale-red colour, hard and strong. The logs are usually sufficiently fissile to be split with maul and wedges, but, if large, may need to be opened up with blasting-powder. The one serious fault of the tree is a tendency to form large radial cracks in drying. For sawing purposes this would have to be overcome by especial care in felling, milling, and seasoning. In its native country, New South Wales, owing partly to its restricted habitat and partly to the abundance of superior hard-

woods, *E. Macarthuri* has not attracted very much attention. In our country it is certainly a tree of immense value. Long experience in the Waikato has proved that its mature heart-wood will easily last twenty years in contact with the ground. For fencing-posts, culverts, and bridges such a timber, however coarse in grain or full of cracks, meets an urgent and persistent demand.

But this tree has much more to commend it than the strength and durability of its timber. It is strongly frost-resistant from the earliest stage of its life, can be very easily transplanted, and grows with phenomenal rapidity to a large size. It is essentially a cold-country tree, and will be found to attain its best in inland districts a few hundred feet above sea-level; but even on the Auckland Isthmus, where it is somewhat out of its range and has suffered from the saline winds, it has outgrown nearly all other eucalypts. If, as we suppose, it is as hardy as *E. viminalis*, it will in the future make a home on the Canterbury Plains and elsewhere in the South Island, and no time should be lost in there making experimental plantings of it. Splendid specimens of this tree may be seen at "Overdale," near Taumangi Railway-station, on the Rotorua line, and in several localities near Cambridge.

Eucalyptus acervula, Hooker f. — This species is indigenous to Tasmania, where, according to L. Rodway, the tree is of medium size with a strong tendency to branch. As we know the tree in New Zealand it is of erect habit and rapid growth. The dead bark persists on the lower part of the stem, where it becomes scaly and rough, but is not fibrous; from the upper stem and branches it comes off in flakes or ribbons, leaving a surface that is of a greenish-grey colour. The leaves of the young plant are oval, those of the adult tree broadly lanceolate or falcate; both juvenile and adult forms are long-stalked, pendent, shiny, often wavy or undulate, and of nearly equal dark green on the two surfaces. The umbel bears normally seven flowers, but may have less or more; its common stalk is about ½ in. long and the stalklets short. The lid of the bud is domed, conical, or pointed. The mature seed-case is small to very small, is wide at the rim, and has just below the rim a slight groove and flange from which it tapers rapidly to the stalklet or pedicel after the manner of a short inverted cone. The points of the open valves may be just below or a little above the rim.

The species was extensively and very successfully planted some years ago in the State forests at Whakarewarewa and Waiotapu, where it has easily endured the cold winters and grown rapidly in height and girth. Specimens planted ten years ago in the grounds

of Wesley Training College are now 55 ft. high with a diameter of 11 in. In Canterbury well-grown specimens may be seen about Christchurch and on the plains as high up as 900 ft. above the level of the sea. No definite information is yet available with respect to the quality of the timber; but a tree so easily propagated, so well able to endure frosts and winds, and of such rapid growth commends itself as certainly worthy of extensive trial.

Through confusion of botanical names the species was introduced into New Zealand as *E. Gunnii*, and also as *E. Stuartiana*; but these names designate two quite distinct species, and it is to be hoped that the confusion will no longer be perpetuated. A New South Wales tree named by R. T. Baker *E. paludosa* has foliage and fruit closely similar to those of *E. acervula*, and may also be represented by specimens in some of our plantations. It is the Tasmanian tree that is here recommended for experiment in our colder districts, and care must be taken not to propagate some other of similar appearance.

SPECIES WITH A RANGE INCLUDING AREAS IN BOTH ISLANDS SUBJECT TO VERY SEVERE FROSTS AND OCCASIONAL FALLS OF SNOW.

Eucalyptus gigantea, Hooker f. (*E. Delegatensis*, R. T. Baker). —The tree as reported from its native habitat develops a long straight bole crowned with luxuriant foliage. The dead bark persists on the stem or part of the stem, and is there matted and fibrous; from the branches and sometimes from part of the stem it falls away in ribbons, leaving a surface that is of a pale bluish-grey or greenish-white colour. The juvenile leaves soon become stalked, rather wide, and somewhat unequal-sided; those of the adult tree are similar but longer and not so wide; both are of about equal green on the two surfaces, or sometimes glaucous. The umbel carries numerous flowers, the common stalk being long, the stalklets short. The lid of the bud is domed or hemispherical. The seed-case is of medium size, pear-shaped, with short thick stalklet; the rim sunk or descending, the valves enclosed.

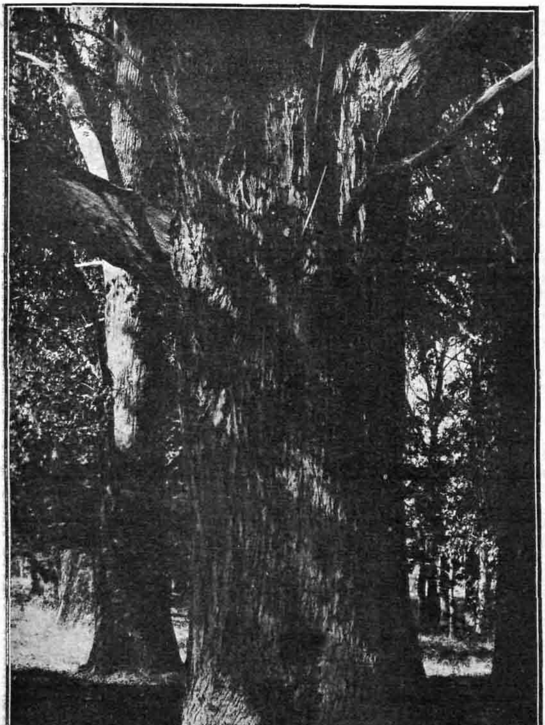
The species is indigenous to Tasmania and south-eastern Australia, and is at its best on the uplands in the region of the winter snow-line. The logs can be easily split into valuable fencing-posts, and are even better for conversion into boards and scantlings under the saw. J. H. Maiden describes the species in his "Forest Flora," Vol. vi, pp. 3 to 8, and concludes by saying, "It, being accustomed to heavy falls of snow, is a useful species for acclimatization in other parts of the world presenting severe but not extreme conditions." Mr. T. H. Williams, District Forester, Tumbarumba,

N.S.W., as quoted by Mr. Maiden in the same article, bestows unstinted praise on this tree as a hardy reafforester and yielder of first-class timber for house-building and general purposes.

The species is closely similar to *E. obliqua*, and has, the writer believes, been occasionally planted in the Dominion under that name; but otherwise it is unknown to New Zealand forestry. One cannot safely say how any species will behave until it has been practically tested; but the probability that this exceedingly valuable timber eucalypt would make itself perfectly at home on our own frosty uplands amounts almost to certainty. Not a season should be lost in obtaining supplies of seed from typical trees above the winter snow-line in New South Wales or Tasmania and putting the question to the test of competent and adequate experiment.

Eucalyptus viminalis, Labillardière. — The specific name, which means "withe-like" or "willow-like," was probably suggested by the graceful and beautiful appearance of the tree, but it does not help us much in separating the species from several others. The tree, in what may be described as its typical form, has a tall central shaft with spreading branches and drooping branchlets. Except for a few feet at the base of the stem, it throws off its dead bark and exhibits a greenish-white smooth surface that often looks as if it had been polished, or touched with white enamel. The juvenile leaves are sessile, opposite, lance-shaped; those of the adult tree are stalked or petiolate, scattered, long, thin, rather narrow, curved to one side, and of about equal green on the two surfaces. The umbel normally carries three flowers, but occasionally has more; the lid of the bud is conical; the mature seed-case is of small to medium size; the rim rises and the valves spring from just within its edge, forming a dome while closed and projecting when open. The heart-wood is pale yellow or sometimes salmon-coloured, never red.

The species is recorded by botanists as indigenous to Tasmania and eastern Australia. The island form is described by L. Rodway as medium to large; of the continental one as seen in their own State Baker and Smith say that it is "a very large tree, probably the largest of New South Wales eucalypts." The species is very widely distributed in New Zealand. It is very easily propagated, either by sowing *in situ* or by transplanting from the nursery. That it is strongly frost-resistant is proved by the evidence of thousands of specimens 600 ft. to 900 ft. above sea-level on the Canterbury Plains. In middle Canterbury, where the phenomenal frosts of 1899 and 1903 seriously injured so many species, *E. viminalis* has made the best recovery.



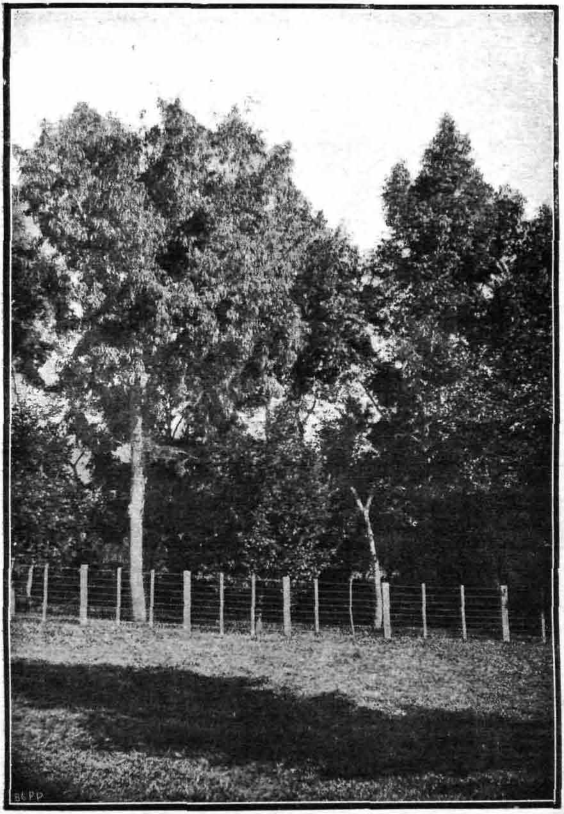
LARGE SPECIMEN OF EUCALYPTUS FASTIGATA IN THE RAILWAY RESERVE PLANTATION, PAPAKURA.

This tree, which has a diameter of 4 ft., is only thirty-two years old, the seed

That this eucalypt can quickly produce for us in New Zealand an immense *quantity* of timber is certain, but there remains to be considered the question of *quality*. Relatively to the many exceedingly valuable and durable hardwoods produced in the Australian States, *E. viminalis* has only a weak reputation; but we have to inquire what its value is likely to be in parts of New Zealand where those superior hardwoods cannot possibly be grown. The position of this eucalypt from an Australian point of view appears to be fairly stated by Mr. Andrew Murphy, of Woy Woy, New South Wales. This gentleman has for many years been carrying on business as a tree-seed collector, and has an exceedingly wide knowledge of the timber-yielding eucalypts. In reply to express inquiries with respect to *E. viminalis* he writes as follows: "It is a very fast-growing tree in its own climate—that is, cold climate —and the cooler the climate the more value its timber will be; not so good when grown in a warm locality. It is a good useful timber, but no good for posts. It is good for rails and palings, &c. —anything out of the ground. Of course, the posts may last ten years easily enough, but we do not consider that anything here; most of our posts last thirty years, particularly *E. corymbosa* and *E. botryoides*."

In making our deduction from this and similar statements we have to remember that timber values are relative to circumstances. We are inquiring just now what the value of *E. viminalis* will be in parts of New Zealand where such durable hardwoods as *E. corymbosa* and *E. botryoides* refuse to grow. The question is one to be settled by our own experience, and such competent experiments as have been already recorded are certainly encouraging. Two of them are as follows:—

(I.) Some posts split out of trees of this species in 1901 when the trees were twenty-six years old were put into a fence in 1902. In September, 1915, the writer, together with Mr. Richard Reynolds, made a careful inspection of the fence. We examined about twenty posts, digging the soil away with a spade and chipping each post with an axe. The sap-wood had decayed, but the heart-wood was still in all cases quite sound. The posts we examined were not specially selected, but taken as average specimens, and not one was found that needed to be replaced. The fence had then been erected thirteen years, and we estimated that the posts would last another four or five years, giving a maximum life of eighteen years. It is fair to say that these posts had been split light, and that a still more favourable report could have been given had they been split with more timber in them. In this and other fences Mr. Reynolds has tested *E. viminalis* side by side with *E. Macarthuri*,



PLANTATION AT WESLEY TRAINING COLLEGE, AUCKLAND, STARTED IN 1906.

The tall tree on the right is *Eucalyptus acervula*, and the large one on the left *Eucalyptus viminalis*.

and as yet neither has outlasted the other. The two timbers are quite easily distinguished by their colour and texture, and can at any time be compared in these fences.

(2.) The second example comes from the St. Leonards Station, near Culverden, North Canterbury. Forty-seven years ago the proprietor of the station, Mr. John H. Davison, sowed a patch of ground with Eucalyptus seed and had a good take. When the trees were twenty years old he cut down some of them and used them for the stringers and sleepers of a bridge. Twenty years after that the foundations of the bridge needed renewal and the upper part was removed to get at them. The sap-wood of the Eucalyptus had decayed, but the heart-wood was still quite sound and was used for fencing-posts, the bridge being decked this time with sawn Eucalyptus planks. The posts after twenty years' service in the bridge and seven in the fence are still sound, and the planks after being on the bridge seven years show no signs of decay except a very little in cracks where rain-water has been held. The writer visited St. Leonards on the 12th February, 1916, and carefully inspected both the bridge and the living Eucalyptus trees. Mr. Davison, who is an intelligent and thoroughly practical man, was clear that the trees used for the bridge were identical with those still standing in the plantations, and the only species found in the plantations was *E. viminalis*. Some of Mr. Davison's trees are now 150 ft. high; and on the neighbouring station of Mount Palm Mr. Thomas Chapman has about two thousand specimens of the same species grown from St. Leonards seed, many of which rival the parents in height and girth.

The object of these remarks is not to encourage the planting of *E. viminalis* all over New Zealand, but to show that where the climatic conditions become too severe for nearly all the larger and more valued species this easily propagated, exceedingly hardy, fast-growing, large, and beautiful tree can still supply the settler with abundant useful timber, and meantime shelter his stock against summer heat and winter storms.

Eucalyptus Gunnii, Hooker f. — In earlier Eucalyptus literature the definition of this species was extended to include as varieties the tree we now know as *E. acervula*, an Australian tree called by R. T. Baker *E. paludosa*, and one or two others. Later research has inclined the botanists of to-day to regard these so-called varieties as distinct species, and to restrict the name *E. Gunnii* to the Tasmanian mountain-tree locally called "cider-gum." It will be convenient for us in New Zealand to accept the restric-

EUCALYPTS ON MR. J. McCARTY'S FARM, CLAUDELANDS, WAIKATO, PLANTED IN 1881.

E. viminalis with smooth white bark *E. Macarthuri* with rough, darker bark.

tion without further hesitation. As thus understood *E. Gunnii* is a medium-sized tree, of branching habit when grown in open situations, but capable of forming a long clean bole when closely surrounded by other trees. The dead bark is non-fibrous and comes off in sheets or scales, leaving the stem and branches more or less smooth and of a pale greenish-grey colour. The juvenile leaves are short, of a round or oval shape, and stalkless or on very short stalks. The adult-tree leaves are stalked, nearly equal-sided, sometimes rather broad, but never very long. The umbel is very constantly three-flowered. The lid of the bud is short and forms a low conical cap to the almost cylindrical calyx-tube. The mature seed-cases vary a little in size and shape, but may be described as oblong or deep-cup-shaped and sometimes contracted a little below the rim. The valves are deeply enclosed, and usually three in number.

The species has found a congenial home in the State plantations at Waiotapu, on the higher Canterbury Plains, as at Racecourse Hill, and especially in Southland, where it is represented by many vigorous and very beautiful specimens. A belt on two sides of the homestead enclosure on the property of Mr. P. C. C. McLeish, in the Drummond district, is particularly worthy of mention. The trees, now thirty-six years old, are in a vigorous growing condition, and stand up firm and erect without any indication of having suffered from prevailing winds. An average specimen carefully measured with the Abney level and steel tape was found to have a height of 100 ft. and a girth of 6 ft. 9 in. Many of the boles are straight and clean, and the majority of them would cut into good boards and scantling if put on the sawmill. Timber from such trees cannot fail to be of considerable value in the near future, and no time should be lost in putting it to the test of competent experiment.

Messrs. Baker and Smith, in their "Research on the Eucalypts of Tasmania," make in respect to the timber of this species the following statement: "The timber is pale-coloured, and very hard and heavy, and Mr. L. G. Irby states that it is almost if not quite as hard as that of the Australian ironbarks *E. paniculata* and *E. crebra*." Mr. Irby was Museum Collector, and had a very wide knowledge of the Tasmanian timber-trees. Seed for propagation of the species should be obtained from the best Southland trees.

Eucalyptus Muelleri, T. B. Moore.—This is another mountain species indigenous to Tasmania, and the accounts we have received of it from its native home place it very high as a timber-yielder.

It is described as a larger and better tree than *E. Gunnii* and equally hardy. So far as the writer is aware, no specimen supposed to represent the species in New Zealand has yet attained a useful size, and there is the possibility that our plants belong to a dwarf or inferior form. Seed should be obtained without delay from the best and largest trees on the mountains of Tasmania, and the species given a thorough trial on some of our cold uplands.

HOW TO START A PLANTATION.

The simplest way to start a plantation of eucalypts is to sow the seed broadcast or with a drill on thoroughly prepared land, just as grass-seed is sown. The seed should be mixed with dry sand to prevent sowing too thickly. It will be a great advantage if the land has already been well manured. Failing this, a little blood-and-bone or guano may be mixed with the sand and seed immediately before sowing. When the work is finished the seed should be within a quarter to half an inch of the surface in a firm but not compressed bed. By using only the two outside hoppers of the drill the seed may be sown in rows sufficiently far apart for after-working. There are two sowing seasons for eucalypts—spring and autumn. Spring is the better when the land is free from weeds and there is sufficient moisture to germinate the seed and keep the young plants going while their roots are still very short. If the land is weedy and moisture uncertain, autumn will be better, at the falling of the early rains. A very little Italian rye-grass sown with the seed will protect the young plants either from the summer sun or from the winter frosts. Mere surface sowing after a burn will often succeed without any further trouble.

Another method is to sow the seed in nursery rows in October or November, wrench the plants as soon as the autumn rains come by driving a spade down along each side of the row so as to cut all the long roots, and then in May or June lift them and puddle the roots and immediately carry them rolled in wet sacks to the planting-ground, and plant them in already prepared places 8 ft. to 10 ft. apart each way. The best puddle will be made with thoroughly decayed farmyard manure and clay mixed with a sufficient quantity of water. The roots must in no case be allowed to become dry, and to prevent this while planting the plants should be carried in a bucket containing sufficient puddle to cover the roots. The very bad transplanters should be individually mossed as soon as lifted from the nursery rows and again heeled in for a few weeks before the final planting. The method simply consists in wrapping the roots of each plant with a pad of damp sphagnum or other

moss, which is fastened with a strip of flax. Small pieces of scrim or old sacking may be used as an outside wrapping to help in keeping the moss together. As soon as a few plants have been thus prepared they should be freely sprayed with water and immediately heeled in. Then within two or three weeks it will be found that the plants have thrown out numerous small rootlets into the moss, and can be removed to their permanent home without risk, always provided that they are still kept damp and planted with the wrapping undisturbed.

Still another method is to prick out the plants in the spring while they are very small into shallow boxes filled with fibrous vegetable mould, and then in the early winter or following spring to plant them out direct from the boxes with a little mould adhering to the roots.

PURE AND MIXED PLANTING.

Theoretically speaking, it is bad practice to mix two or more species together, and yet in actual experience many a man has been saved from failure and disappointment by doing this very thing; for again and again it has happened that out of several species sown or planted in a particular locality one or two have done well, while the others have for some cause proved unsatisfactory. Pure planting is certainly best wherever conditions guarantee a good take and a uniform crop, as will generally be the case in systematic State forestry; but for the busy amateur mixed planting will often be safer. The one thing to be rigidly insisted upon is that the species planted together shall be of equal rapidity in height-growth, so that no one of them may overtop and depress the others.

For wind-break purposes it will sometimes be desirable to mix a few plants of *Pinus insignis* with such rapid-growing eucalypts as *E. Macarthuri*, *E. viminalis*, or *E. fastigata*, examples having shown that these trees all maintain about the same rate of upward growth and blend well together. *Cupressus macrocarpa* may also be planted with eucalypts for wind-break purposes. In exposed situations near the sea it will always be advisable to place a screen of hardy pines on the outside of the belt, as many of the eucalypts, even though they may be extremely hardy inland, suffer at their tender growing tips from exposure to the full blast of saline winds. It must be remembered, too, that trees help trees, and that wide belts always give better results than narrow ones. Single or even double rows along boundaries are unsatisfactory. It is better to plant a belt 60 ft. to 100 ft. wide, and better still to plant a square block of several acres.

PROTECTION AGAINST STOCK, ETC.

Eucalypts, like all other trees, must be securely protected against stock. It is only a waste of time, money, and good temper to plant trees for the farm animals to destroy. An ordinary seven- or eight-wire fence with plenty of battens will be sufficient protection against sheep, cattle, and horses, provided a space of 6 ft. is left between the fence and the nearest row of trees; but the fence must be kept tight and in good order. If rabbits and hares are numerous it will, unfortunately, be necessary to protect the plants while young against them also, by netting the lower half of the fence. The correct rabbit-netting is 42 in. wide, with a mesh of 1½ in., and of 16 to 17 gauge wire. Six inches should go into the ground, and the remaining 3 ft. be stretched tight and well fastened to the posts and wire. If the mesh is larger than 1½ in. small rabbits may pass through and live inside the plantation.

SEED-SUPPLY.

There remains the vital question of seed-supply. Intending planters by carefully using the foregoing descriptions may in many instances identify local trees and collect for themselves. If the twigs bearing the ripe fruits are laid out on a floor or hung up in a sack, the seed will within a few days fall out of the cases, and can then be easily separated with a sieve. But more frequently it will be found necessary to purchase the seed, and it is here that we encounter a great risk. The ordinary seedsman has to purchase from other seedsmen or from collectors. Quite honest collectors, unless possessed of considerable botanical knowledge, may make mistakes and unwittingly deceive the seedsman, who will then just as unwittingly pass the deception on to his customers. In this way the planter may find, after spending his time and money and waiting long years, that he has planted the wrong trees and failed of the result that he had a right to expect. Until the Government Forestry Branch can supply the seeds, or some one New Zealand seed-house will undertake to keep guaranteed stocks, planters who cannot collect from local trees will be well advised to import the Australian seeds direct from Andrew Murphy, tree-seed collector, Woy Woy, New South Wales, who knows all the timber-yielding eucalypts well, and is thoroughly accurate and reliable. The special Tasmanian species may be obtained from C. Creswell and Co., seedsmen, Hobart.

CONCLUSION.

Many farmers and settlers will no doubt desire information about numerous eucalypts not mentioned in this article. They must be

asked to wait until all the important species now growing in this country and others thought worthy of introduction can be described in the proposed forestry handbook or in a separate bulletin. Several eucalypts yield much more durable timbers than the majority of those described above, but they are all comparatively tender and slow of growth. First plantings everywhere should be of sure and heavy croppers.

There are many examples in New Zealand of the self-propagation of eucalypts, and the writer hopes to contribute an article on that subject to some future number of the *Journal*. A full account would then be given of two species that have spread very remarkably from a few parent trees at Waitati, in Otago.

NOMENCLATURE OF EUCALYPTS.

It will be observed that in the foregoing article popular names have not been given for the eucalypts dealt with. Writing to the Editor, Mr. Simmonds makes the following remarks on this subject: "I have given a great deal of thought to the question of bushmen's names, and corresponded with Australian foresters about it. The result is that I have no hope whatever of deriving a useful nomenclature from this source. Even in Australia these names are in hopeless confusion, and here in New Zealand we lack the local associations and explanations that sometimes give them a little colour of appropriateness in limited areas over there. If I call *Eucalyptus fastigata* 'cut-tail,' what possible meaning can the word have here? If I call *Eucalyptus pilularis* 'black-butt,' I shall set people looking in vain for black bark on the stems of *Eucalyptus pilularis* trees in this country. There are six stringybarks, five ironbarks, several boxes, three blue-gums, three or four red-gums, as many mountain-ashes, two or three 'messmates,' three or four peppermints, and quite a large group of white-gums. One or two species rejoice in being called apples. The use of these names as we find them in seedsmen's catalogues is worse than useless. Let us use them as little as possible and prepare to drop them altogether in favour of the botanical names, which anybody may quickly learn by associating them with the trees."

Demonstrations at Arataki.—With a view of bringing the Hawke's Bay fruitgrowers into closer touch with the Arataki Horticultural Station arrangements have been made, in co-operation with the advisory committee of the Hawke's Bay Fruitgrowers' Association, to hold practical demonstrations at the station at regular intervals. The first gathering of the series was held on the 25th March, and took the shape of a demonstration of hard-pan breaking by means of explosives, conducted by Mr. A. H. Mazure, Vine and Wine Instructor, who has had considerable experience of this method in Australia. An orchard-ploughing competition will be held shortly, and the Horticulture Division has asked the committee of the Fruitgrowers' Association to draw up rules for this event.

POLLEN-GRAINS AS SOURCE-INDICATORS OF HONEY.

CONTINUED.

R. WATERS, *Biological Assistant.*

THE first account of the work under the above head done by the writer appeared in the *Journal* for September last. A further account, with illustrations and descriptions of some of the more important ellipsoid pollens, was published in the November issue. Reference to these two articles will afford those interested such details concerning the objects of the investigation, the methods employed, and the system of classification as will give a better understanding of the following notes in continuation of the subject.

ELLIPSOID POLLENS.

Type II (*Gorse Type*).

Similar to gorse are,—

Broom (*Sarothamnus scoparius*) figured and described in *Journal* for November, 1915, p. 387.

Apple (*Pyrus malus*).

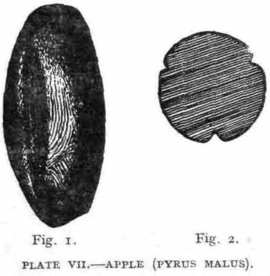


Fig. 1. Fig. 2.

PLATE VII.—APPLE (PYRUS MALUS).

Fig. 1, side view. Fig. 2, transverse section through the middle of the longitudinal axis. Natural size: Length, 50·4 μ; breadth, 24.3 μ. Magnification, 920 diameters. [*Original.*

Apple differs from gorse and broom in its noticeably greater length and breadth. In transmitted light the yellowish-green shade of fresh specimens is readily distinguished from the golden-yellow and very pale watery yellow of fresh broom and gorse respectively. This pale-yellowish-green shade of apple is similar to that of wild turnip, from which, however, it clearly differs in its greater length and breadth, in its polish due to its capacity for transmitting light, and in its smoothness of surface. The shape of apple is often less regular than that of the other two. Magnified 465 diameters, the surface sculpturing appears as of minute striations, sometimes composed of straight lines, sometimes of curved. Again, the sculpturing may appear as granular. In these surface characters the appearance of apple differs from the reticulated sculpturing of broom and the still finer one of gorse. Sculpturings are often more clearly shown when the grains have been crushed flat on a glass slide.

Type IV (Red Clover Type).

Fig. 1.

Fig. 2.

PLATE VIII.—RED CLOVER (TRIFOLIUM PRATENSE).

Fig. 1, side view. Fig. 2, transverse section through the middle of the longitudinal axis. Natural size: Length, 50·2 μ; breadth, 30·7 μ. Magnification, 920 diameters. [*Original.*

Red clover (*Trifolium pratense*) is a type easily distinguished from types I (white clover), II (gorse) and III (wild turnip) by reason of its noticeably greater breadth and length. In cubic capacity red clover appears two or more times greater than gorse, the largest of types I, II, and III. Unlike II and III, the ends of red clover are bluntly rounded—not pointed. Moreover, in proportion to its size, the grooves of red clover are relatively noticeably shallower and narrower than I and II. Red clover is most

distinct in surface sculpturing, the very coarse and bold reticulation of which alone justified its classification as a separate type of ellipsoid pollen.

Type V (Escallonia Type).

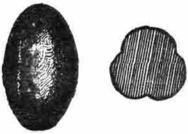


Fig. 1. Fig. 2.

PLATE IX.—ESCALLONIA (ESCALLONIA MACRANTHA).

Fig. 1, side view. Fig. 2, transverse section through the middle of the longitudinal axis. Natural size: Length, 29·1 μ; breadth, 18·0 μ. Magnification, 920 diameters. [*Original.*

Escallonia (*Escallonia macrantha*), the common dark-foliaged pink-flowered hedge-plant, differs sufficiently in the size and shape of its pollen-grains from previously mentioned types to justify its classification as a separate type. Of the other types, it resembles type III (wild turnip) most, mainly in its colour, which in transmitted light is of slightly paler yellowish-green than the shade common to both type III and apple. It is, however, noticeably broader in proportion to its length than wild turnip, and its ends are more broadly rounded. Moreover, it is not opaque like type III, but highly transmissive of light; this character lends a highly polished appearance to its surface, which under a magnification of 465 diameters appears also as almost imperceptibly reticulated. Some of the grains of Escallonia approach more or less a spheroidal shape—these are probably immature pollens.

STACKS OF OATS AT RUAKURA THATCHED WITH RYE-CORN STRAW.

DISEASES OF THE VINE.

PREVENTIVE AND REMEDIAL MEASURES.

A. H. MAZURE, Vine and Wine Instructor.

THE majority of the methods described below for coping with the various diseases of the vine have been thoroughly tested in all the leading wine-growing countries of the world, and can therefore be recommended with confidence. There are also some treatments which are practically new, and further experimental work will be necessary before finally deciding their respective values. It is not always a wise course to wait for the disease and then treat it. In districts where vine-diseases are known to exist, preventive measures are always the best. Most of the following treatments are based on the fact that prevention is better than cure.

VINE OIDIUM (OIDIUM TUCKERII.)

This is probably the best-known fungus disease in vine-growing, and is fortunately the most amenable to treatment. Nevertheless, it can be very troublesome, particularly in cool vinehouses. Vines attacked by oidium may be recognized by the following symptoms : The green parts become covered with a whitish dust, and after a while grey spots appear on the places attacked. Close and moist weather-conditions are favourable to the development of oidium.

Sulphur (triturated) is probably the best remedy for mildew. A new remedy described in the December issue of the *Journal*—namely, permanganate of potash—appears to be gi-ing excellent results in France. However, as sulphur is the standard treatment and a fairly sure remedy if applied at the right time—November, December, and January—it will be advisable to give some particulars of it here, and to leave the permanganate remedy until further experiments have been carried out with it. Three sulphurings at the very least should be carried out. The first two are the most important. It is absolutely necessary that the sulphur should be applied when the shoots are from 8 in. to 10 in. long, and also during the florescent period ; again in December, and, if necessary, again in January. The quantities to be used per acre are—for the

first application, 8 lb. to 12 lb.; for the second, 15 lb. to 24 lb.; and for the third, 30 lb. to 35 lb. Choose, if possible, warm calm days. *Be sure to use the best sulphur, and see that it is finely ground, as this will ensure the foliage being completely covered.*

BLACK-SPOT (ANTHRACNOSIS).

This disease is caused by a microscopical fungus called *Sphaceloma Ampelinum.* It is undoubtedly one of the worst diseases of the vine, and is very difficult to cope with. It can be readily recognized by spots or cankers appearing on the green parts of the plant. The spots are small when the disease commences, and then extend, gradually sinking into the tissues. If some preventive measure is not used the disease generally results in the total destruction of the crop and in many cases of the vine. It is very prevalent in damp muggy seasons on low soils. I have noticed in New Zealand four varieties that are particularly susceptible to black-spot—namely, Thompson's Seedless, Golden Chasselas, Temperano, and Cabernet Sauvignon.

In districts where the disease is known to exist everything that can be done should be done to prevent a recurrence, for when started on the young growth it is extremely difficult to check—in fact, it has been found almost impossible to then control the trouble. In planting, avoid any notably susceptible varieties of vines, and do not plant in situations which are favourable to the development of the disease.

The treatment which so far has proved most successful in France and in Australia is the following one: A 10-per-cent. solution of sulphuric acid is applied to the vines in the winter as soon as possible after pruning. Use a mop made with rags tied to the end of a stick and paint the solution on to the wood. If a spray-pump is used it should be lead-lined. *Be sure and wet the vine all over.* This will destroy a large number of spores, which would have started the disease early in the spring. An application is made, just before the florescent period, of triturated sulphur and bolted lime in the proportion of sulphur 4 parts and lime 1 part. Immediately after the florescent period a further application of sulphur 3 parts and lime 2 parts is given. A few days later another application is made in the proportion of sulphur 2 parts and lime 3 parts. *This should be repeated until the disease is* completely eradicated.

As black-spot is extremely prevalent in this country the treatment just mentioned should be given a thorough trial here. It is

claimed that, although a good deal of labour is entailed in carrying it out, the treatment practically eliminates the disease for at least three years. If such is the case the cost naturally amounts to very little.

Another useful check for black-spot is Bordeaux mixture at the rate of 4-4-40, but this spray is by no means a cure, nor is it a preventive for the disease.

Spraying with lime-sulphur, 1 in 125, after the florescent period, is also a preventive, provided it is followed later by a solution of increasing strength as the growth of the vine becomes stronger. The strength of the mixture should gradually rise until 1 in 80 is reached. It is not advisable to have it higher, as otherwise the spray tends to burn the vines severely.

GRAPE-ROT (BOTRYTIS CINEREA).

Thin-skinned grapes often rot when the weather is damp and rainy at the time of ripening, and particularly so if the vineyard is in a low situation. This is due to a fungus, *Botrytis cinerea*. This fungus also affects the wine which is made from affected grapes, causing the disease called "casse." The best cure for the disease is to strip the leaves *below* the bunch a few days before picking the grapes. This allows a free current of air, and more heat is reflected from the soil, the action of both factors helping the maturation of the fruit. This disease is sometimes known as grey-rot.

BLACK-ROT (PHOMA NIRCOLAE).

Black-rot is first seen on the berries as a bluish-red spot, which increases in size and eventually surrounds the whole fruit. After this stage it becomes red-brown and soft, and the berries will dry in three or four days, the colour becoming nearly black and the skin adhering to the pips, while the whole surface is covered with small prominent brown spots. These latter make their first appearance when the fruit is gradually drying.

The disease appears to develop easily in low and very damp situations, particularly with varieties of grapes of a very juicy nature. The best means of coping with this trouble is to spray with Bordeaux mixture, 3-3-50, taking care that the spray thoroughly covers the vine. If the mixture is applied four or five times in the season the disease will be entirely overcome.

(TO BE CONTINUED.)

LUCERNE-GROWING.

A CANTERBURY OBJECT-LESSON.

A REMARKABLE example of the value of lucerne as a fodder crop, and its adaptability and productiveness under most unfavourable conditions, has been furnished during the past season on the farm of the School for the Deaf, at Sumner, near Christchurch. An account of how, with bare grass-paddocks, the half-dozen cows of the institution were kept in good condition and yield during a

THE COWS FED FROM THE SCHOOL-FARM LUCERNE PLOT.
The grass-paddock here shown was practically bare.

droughty spell of four months and a half by means of half an acre of lucerne growing practically on sand is contributed below by Mr. J. E. Stevens, Director of the School. The majority of dairymen and other farmers in Canterbury—men depending in summer on grass, with perhaps some of the commoner forage crops—have had such a hard experience this past season that no excuse is needed to point a moral from this Sumner object-lesson. Dealing first with the establishment of the lucerne plot Mr. Stevens says,—

"Our first trial in lucerne-growing was made in the autumn of 1908, when we sowed down a quarter-acre, which germinated well,

LUCERNE PLOT AT SCHOOL FOR THE DEAF, SUMNER.

Showing fifth crop of the season, ten days off full growth. This part of the plot was sown only fifteen months previously.

but which was soon smothered with weeds. In the following spring the same plot of ground was prepared again, to see if better results could be obtained at that season of the year. The lucerne again germinated well, but so did the fat-hen, and the result was again a failure. The plot was put back into grass, and nothing further was done in the way of lucerne-growing until the spring of 1913. Then, on the advice of officers of the Department of Agriculture and following out their instructions to the letter, we selected for a further experiment the most worthless piece of ground on the School farm, a quarter-acre of sand hummocks covered by a very thin coating of soil. This area was levelled, what soil there was being kept on the surface, and a dressing of 4 cwt. of lime applied. The seed was sown in rows 15 in. apart, not broadcast as in our previous experiments. The seed germinated well, and when the rows could be easily distinguished the hoe and the Planet Junior cultivator were kept going between them. When the crop was about 6 in. or 8 in. high it was cut and left on the ground for a mulch. After that, beyond resowing one or two bare patches, we had no further trouble. The following spring, 1914, we increased the size of the plot to a little less than half an acre, and it is now well established. With both these sowings inoculated soil was used.

"As showing the value of lucerne as a fodder crop, I may say that the past year was the driest we have ever experienced, and, in consequence, from the beginning of October until the middle of February, when the rains came, our paddocks were almost devoid of grass. Yet during the whole of that time we were able, with our lucerne as almost their only feed, to keep our six cows in splendid condition. During that time four cuts were taken from the plot, each averaging 3 ft. in length. A fifth cut was made in March. This crop is shown in the photograph, which, however, does not give as good a representation of it as might have been the case, for, apart from the lucerne being about ten days off its full growth, the recent rain had made it lie down to some extent. As indicated, the other four crops were much higher when cut. No manure was used, and the land has not been irrigated. The plot has been kept scrupulously free from weeds by regular cultivation between the rows, and this has been, I think, the main reason why the growth has been so good.

"This season we are laying down a further area in lucerne, and are experimenting with nine varieties of seed supplied by the Department of Agriculture — viz., Turkestan, Peruvian, Poitou, Provence, Russian, Spanish, Dryland, Hungarian, and Arabian."

SHEEP IN NEW ZEALAND.

MR. CLIFTON ON THE BREEDS.

In the course of a recent address to the National Woolgrowers' Association of America Mr. E. Clifton, late New Zealand Commissioner at San Francisco, gave the following sketch of sheep breeds in this country, which will be read with interest by many of our sheep-farmers and others :—

There have been introduced into New Zealand sheep of every breed. After trials, those remaining in general use are,—

The Merino, that is the basis of our flocks, but now very much less in numbers than formerly, contributing only 9 per cent. of the sheep of the country. Our Merino sheep are smaller and more active than your splendid Rambouillets. Yours are much heavier in wool and in grease, ours are plainer in fleece but equally as fine in the wool. Still, we have many types. A favourite is a sheep producing a strong combing-wool. That wool is in great demand.

The Romney.—This is the dominating sheep of New Zealand, the very special reason being that the Romney is of eminent vigour of constitution. The sheep itself is of sturdy form ; the wool is improved in quality and increased in weight. Further, it crosses well with most other breeds, and the ewe is an excellent mother.

The Romney was introduced with the first of the British longwools. The greater part of the original flock was dispersed many years ago, but a part has been continued in the flock of the doyen of the Romney men, Mr. Alfred Mathews. Some of this gentleman's sheep were very successfully presented for competition at the Panama Pacific Exposition.

We believe that the New Zealand Romneys are an improvement on the sheep of their own original home in Kent. There, close to the great meat-market of London as it is, the chief aim was the production of a sheep for the butcher. We claim that owing to this fact sufficient attention was not directed to the wool. It is believed that the New Zealand sheep retain the form and constitution, with a fleece of heavier, evener, and better quality of wool.

We demand that the Romney ram shall exhibit a thoroughly masculine head, a bold eye, a good carriage, strong neck, level wide back and l... well-sprung ribs, and a full quarter. It is possible that all this ...ed for in all sheep, but it is certainly these characteristics that ...d present in the type of Romneys that our flockmasters have ... in standardizing in New Zealand.

...ntirely accepted that the wool of the Romney exhibits varia- ...ere are considerable differences in the wool of individuals of ...there is still greater divergence in the flocks of breeders. This ...n to all breeds, but is probably accentuated in the Romney.

But this feature is diminishing; our breeders are working to a single type—a wool of fine staple, good length, free, fairly dense, and lustrous. The fleece should open freely—that is, there should be no cross-fibres holding the locks together.

A well-bred, carefully selected, well-conditioned flock of ewes and hoggets with a fair proportion of wethers has clipped up to 10½ lb. of wool. A stud flock is reported of which the ewes clipped 21 lb., hoggets 22 lb., and the rams 28 lb.

As a sheep for the butcher the Romney is also esteemed.

To repeat, it is vigour and constitution that place the Romney foremost among the flocks of New Zealand.

The Lincoln.—The Lincoln was at one time in the highest favour both as a purebred and for crossing purposes, and still holds prominence. This breed, that of all sheep provides the greatest weight of meat and wool, is firmly established in the estimation of those breeders whose farms are situated on rich soil. The Lincoln is the sheep of the heaviest and richest districts of New Zealand. It requires better feeding than some other sheep, and it responds generously to liberal treatment.

The Lincoln has been selected by the New Zealand sheep-breeder, with one exception, as the sire the most suitable for development of the Corriedale.

The *English Leicester.*—The New Zealand type of English Leicester is a very different type of sheep from the fashionably bred animals that have been lately imported from that country. They are tall sheep; in colonial parlance, they are "on the leg." They are certainly large sheep, but it is extremely doubtful if the wool is as fine, or if it is even of a true Leicester type. To us of New Zealand the modern English Leicester fails to appeal as did those beautifully formed sheep of the older type, Bakewell's English Leicester, the autocrat of the British longwools.

The Border Leicester.—This sheep is in special favour in the southern part of the South Island, where the farmers are chiefly of Scottish origin. It is of great hardiness, and is in favour with the butcher.

The Southdown is used entirely for the production of crossbred lambs for refrigeration. The half-bred Southdown lamb matures early, and at a weight of 32 lb. it is well finished in the condition and at the weight most desired on the London market.

The Shropshire is used for the same purpose as the Southdown. It is claimed, however, that the lambs do not fatten quite so quickly as the Southdown cross, and that when fat they are heavier than is desired for refrigeration.

Corriedales.—Of all the breeds of sheep the New Zealand Corriedale and its evolution attract the greatest interest. A sheep was wanted to take the place of the Merino on the more fertile and better-grassed hills and for the heavier soils of the plains—one that would submit to the greater restraint than the Merino that throve on the open hills. A flockmaster of our country, Mr. James Little, was seeking such a sheep. He wanted a wool with the best characteristics of the Merino with the form of one between an English Leicester and a Down—a sheep for

wool and mutton. He entered on the undertaking, and created the Corriedale. The name of the property—"Corriedale"—was that given to the sheep. In 1865 the first cross was made—a Lincoln ram with a Merino ewe. From this progeny selection was made. Not then satisfied, another cross of the same breeds was made, with selection on different lines. This has been continued with marked success.

The system that Mr. Little originated has since been followed by others. There are now twenty-two registered stud flocks of pure Corriedale sheep.

With one exception, where an English Leicester was used, the New Zealand Corriedale is the progeny of a Lincoln sire with a Merino ewe. The breeding of the selected progeny then continues without further crossing. The Corriedale is therefore the result of the continued and careful selection of the inbred progeny of half-bred or first-cross parents. Most undoubtedly to secure and maintain the desired type the most skilful selection extending over many generations is essential. It may be accepted that those sheep-breeders who have secured the recognition of their flocks have been most justly rewarded for their perseverance, and the New Zealand Corriedale is being appreciated in many lands.

The appreciation may well be merited. The Corriedale was evolved from decidedly divergent parents—from those, indeed, of a violent contrast—the active mountain Merino, the inactive Lincoln of the rich level country; the Merino probably the oldest of the breeds of domesticated sheep, the Lincoln already a cross of the original breed and an English Leicester.

The establishment of the Corriedale is an interesting subject to the student of breeding. If there be the intention to further introduce this most desirable sheep into the United States, let it be in sufficient numbers to permit of liberal selection of the progeny; for, however careful and skilful the purchaser, there will be, as in all breeding, some to discard if the type is to be maintained.

Half-breds.—There is in New Zealand yet another most interesting development in sheep-breeding—one that I should be unwilling to mention unless with the support of the record of the New Zealand Flock-book. It is the use of a direct half-bred ram on half-bred ewes. I may be permitted to read a copy of the record in Volume IV, as follows:—

> In 1886 a commencement was made in breeding half-bred sheep by Lincoln rams from Merino ewes at Stonyhurst, and the main breeding-flock is now half-bred. The practice throughout has been to mate first-cross Lincoln-Merino rams with half-bred ewes, which are now descended from many generations of half-bred mothers. The stud rams bought have been exclusively Lincolns from the flock of Mr. H. J. Hall, and after its dispersal from that of Mr. J. S. Holmes; but they are now bred in the Stonyhurst Lincoln flock. These rams have been used with the Stonyhurst stud Merino ewes to produce half-bred rams. The result has been to create a very level flock of about ten thousand half-bred breeding-ewes. The hoggets are culled before March, and the faulty ones are thrown out to breed fattening-lambs by Shropshire Down rams. It is now found sufficient to take about 15 per cent. The success attained is attributed to the persistent use of the same types of Lincoln and Merino sheep from the same stud flocks. Experiments have been made in breeding rams by prize half-bred rams from picked half-bred ewes; but sheep so bred, though generally satisfactory, have not displaced the first-crossbred rams for use in the station flock. For supplying these rams a selection of the Merino stud flock is annually drafted to be put to the stud Lincoln rams.

The flockmaster in question (Sir George Clifford) is one of the foremost sheep-breeders of our country, and lately there are others, among them one of the very shrewdest of our sheep men, breeding these same sheep as described in the record just read to you.

There are claims and counterclaims for the Corriedale and half-bred as to which results in the better or the more even flock. Both are crossbreds—the half-bred the more immediate.

CANTERBURY SEEDGROWERS' ASSOCIATION.

THE following communication from Dr. F. W. Hilgendorf, of Lincoln College, will, it is hoped, act as a reminder to farmers of the seed-improvement work now being pioneered by the Canterbury Seedgrowers' Association, and stimulate extended support of the movement :—

The association exists for the purpose of providing good and pure seed to farmers. It consists of farmers who have appointed an inspector to examine their crops and seed, and to keep all members in touch with each other and working on the same lines.

The procedure is as follows : A member notifies the inspector when his crop is nearly ripe, and the inspector examines it standing in the field. If it is true to name and sufficiently pure and free from weeds he agrees to register the crop. If it is not sufficiently pure he advises the grower to remove impurities from an acre or so, in order to have pure seed for next year. After harvest the grower of any crop that has been passed sends a large sample of his seed, which the inspector then examines for purity and germination-capacity. If still satisfied, he then again visits the farmer, samples all the bags, compares them with the sample on which he made his analysis, and seals the bags with the association's seal.

Only a small number of growers have so far joined, but it is hoped that the numbers will now increase. Any one that is willing to take the small amount of trouble requisite to grow pure seed of any kind whatever is eligible for membership if he lives in or near Canterbury. Later on other associations may be started in other centres. There is probably a good demand for registered seed of wheat of the established varieties, for Algerian, Dun, Danish, and other oats, as well as for the grass and clover seeds.

While comparatively few farmers can make a speciality of seedgrowing, yet it is to the advantage of all farmers to have the association well established, so that they may have in time a sure source of good seed when they wish for a change of either wheat, oats, barley, grasses, or clovers. Any one can help the association this year by purchasing seed from the growers of registered crops, so that they may be encouraged to continue their efforts and expand their operations. Wheat-seed of three varieties—College Hunters, White Tuscan, and Solid-straw Tuscan—is available for the coming seed-time.

Particulars of growers and registered crops will be supplied on application to the writer. Any farmer wishing to join the association is also requested to communicate with the writer, whose address is Lincoln College, Christchurch.

The best cropping-potato this season at Weraroa Experimental Farm has been Maori Chief, yielding 14 tons per acre, and the tubers being of good size and quality for table use. Gamekeeper was a good second with 12 tons per acre, and proved the best blight-resister. Seasonal conditions generally have been adverse for potato-growing at the farm.

ENSILAGE NOTES.

W. DIBBLE, Assistant Fields Instructor.

IN the writer's travels through the Dominion, in the course of his special work as ensilage instructor, he has noted with considerable encouragement that once ensilage is made under personal supervision in a district the practice extends from season to season. Ensilage has been specially appreciated during the droughty seasons experienced—in fact, many dairymen milking large herds now candidly admit that they could not do without it. Ensilage, however, is still very much neglected in most districts. It was reported in March that in some districts farmers were milking their herds once daily owing to the falling-off of the milk-supply. This seems incredible in a country like New Zealand. The quantity of surplus feed that was allowed to waste during the spring months of 1915 was enormous, many thousands of tons of valuable material that could have been utilized for ensilage having been lost.

Some stack ensilage made from meadow-grasses, recently shown to me, was quite equal to the best pasturage growing at that season. The sample referred to was light green in colour, had an excellent aroma, and was very succulent. Some persons have an idea that ensilage should be black and have a disagreeable odour, but with sweet green ensilage such is not the case. The sweetness and light colour are obtained by regulating the temperature between 125° and 145° F. Attention to control of temperature is no doubt the secret of success.

Many farmers complain of the labour attached to the making of ensilage. With up-to-date appliances silage can be made with very little labour—stack ensilage now being referred to. The principal work is in the building, which is easily accomplished if instructions, given personally or in the Department's publications, are carried out. Ensilage will keep good for many years in stack form. In early autumn the chief material available is maize, which when converted into ensilage makes a very valuable asset for producing milk. Maize has proved to be rather disappointing when fed green. It has a tendency to put on flesh rather than produce milk. But when made into ensilage it is found to be an

excellent milk-producer, and is readily digestible. Not only does silage increase the quantity of milk, it also improves the quality.

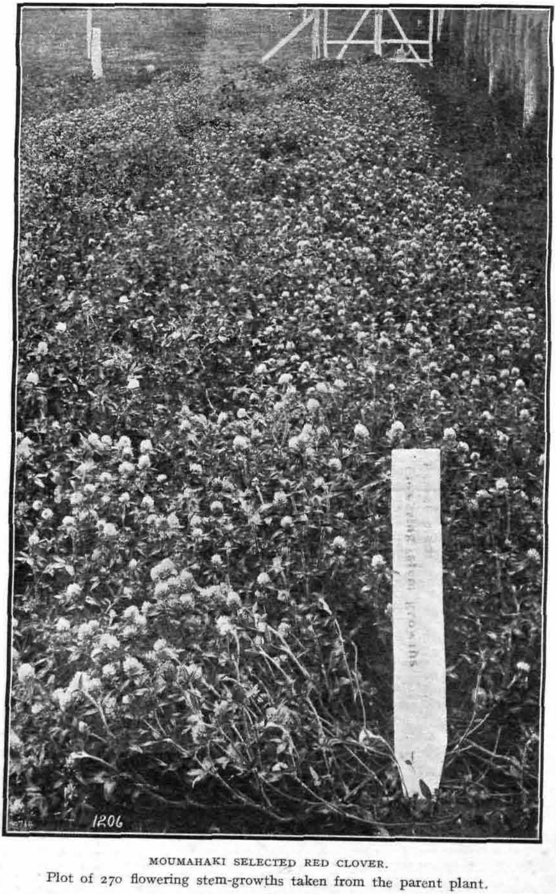
It cannot be too often urged that farmers should pay more attention to conserving fodder for their stock, and thus increase the carrying-capacity of the land. Too many find their mistake in being overstocked at this season, with insufficient provision made for autumn or winter feed. In the present international situation it more than ever behoves the farmer, with regard to live-stock, to breed and feed to his utmost ability.

IMPROVEMENT OF RED CLOVER.

J. BEVERLEY, Assistant Plant-breeder.

IN connection with plant-breeding operations at Moumahaki Experimental Farm considerable attention has been given to red clover and cow-grass. A red-clover single-plant selection (five years old, August, 1915) is being developed at the present time. Usually red clover dies back after flowering, but in this case the flowering-stems layer themselves with ease, which indicates that the selection is likely to be truly permanent. From the parent plant 270 flowering stem-growths were removed and planted out in rows 3 ft. apart in October, 1915. The photograph on the following page shows the vigorous growth and seeding of these plants three months later in January, 1916. The parent plant gives a large kidney-shaped good-coloured seed, and a little over a thousand seedlings have been grown from it as single plants, the best of which are now under observation for further selection. It is interesting to note that 4 per cent. of the seedlings have white flowers.

In another experiment several varieties of red clover were sown in the open at the end of May, 1915, with a view to the winter killing off all the weakest plants. Some germinated and damped off later. Runciman's clover, however, did well under these winter conditions of seeding, and is worthy of notice in many other respects. This clover is supposed to have been brought from England by the early missionaries, and to have been perennial for over forty years on the site of a mission station near Paemako, on the Mokau River, twenty miles from Te Kuiti. Mr. Runciman, who had a property at Paemako, recognized the value and perennial nature of the variety, and spent time and money in propagating it. From this source it is now found in many places.



MOUMAHAKI SELECTED RED CLOVER.

Plot of 270 flowering stem-growths taken from the parent plant.

(See preceding page.)

SEEDS AND THEIR IDENTIFICATION.

CONTINUED.

E. BRUCE LEVY, Biological Assistant.

(1.) Rib-grass *(Plantago lanceolata)*.

(2.) Greater Plantain *(Pantago major)*.

(3.) Rugel's Plantain *(Plantago Rugelii)*.

(4.) Bracted Plantain *(Plantago aristata)*.

(5.) Large-leaved Plantain *(Plantago hirtella)*.

(6.) Shore Plantain *(Plantago Coronopus)*.

RIB-GRASS is a very common impurity in most agricultural seeds, and the weed itself is common in almost any pasture.

Greater plantain is fairly frequently met with. The plant is common in pastures and waste places.

Rugel's plantain is fairly common in imported seed, but the plant has never yet been recorded growing in New Zealand.

Bracted plantain is very common in imported meadow-fescue of American origin, and is looked upon as a source-indicator for this seed. The plant itself has never been recorded in New Zealand, although the writer has raised plants from seed sown in pots, which plants produced mature seed.

Large-leaved plantain is a rare impurity, although the plant is very common throughout the Auckland District.

Shore plantain is not commonly met with. The plant is restricted almost entirely to seashores, and is very plentiful around the Hawke's Bay District.

When present in small numbers none of the above-mentioned seeds are of any moment in lines of seed.

RIB-GRASS.

Size: Average length, $\frac{1}{11}$ in.; average width, $\frac{1}{25}$ in.

Colour: Amber-coloured to a dark brown, both colours often being present in the same seed.

Shape: Shaped like a shallow, thick-walled canoe, with ends rounded alike, the cavity varying in size from a mere slit to a wide shallow depression. The sides of the "canoe" present a folded-over appearance, and are at times folded almost to meet each other. In the centre of the cavity is a roughened, slightly raised, and often dark-coloured scar. The bottom of the canoe-like seed is often light amber in colour, while the walls are generally much darker. The surface of the seed is smooth and shining, the convex surface being more shiny than the concave. Occasionally a seed is met with the surface of which is somewhat minutely waved or very finely sculptured. The seeds are borne in pairs in the seed-head, cavity to cavity. Between each seed thus placed is a thin corky-like straw-coloured partition. This partition occasionally adheres to the one or the other seed, especially when the seed is immature. The seed when moistened for some hours becomes enveloped in a thick layer of transparent mucilage.

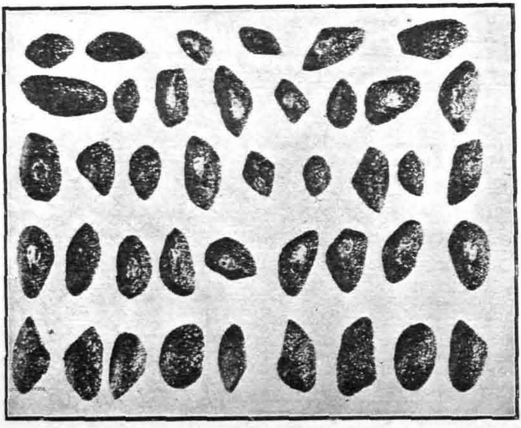
GREATER PLANTAIN.

Size: Very variable. Average length, $\frac{1}{20}$ in.; average width, $\frac{1}{32}$ in.

Colour: Light to dark brown, generally tinted with green, often quite dark-greenish to black.

Shape: Extremely variable; oblong and flattened, one end usually more pointed than the other; seed often almost triangular, and often irregular in outline—at times oval, rhomboidal, or trapezoidal in outline when lying flat. The flat surface is generally slightly curved upwards at the ends, and at times is slightly twisted. The edges of the seed are acute. The inner surface is raised gradually to a central point marked by a distinct whitish scar. This scar is generally situated about the middle of the surface, but is placed at times near one end. This scar marks the point of attachment of the seed to the central partition in the seed-capsule. Situated near the scar is a small depression, and radiating from this and completely covering the seed are very fine wavy lines. These lines are very distinctive, and distinguish this seed from that of Rugel's plantain, next described. The surface of the seed is dull and rough in appearance. The seed when wetted for some hours becomes enveloped in a thick coating of transparent mucilage.

RIB-GRASS (PLANTAGO LANCEOLATA). ENLARGED 10 DIAMETERS.



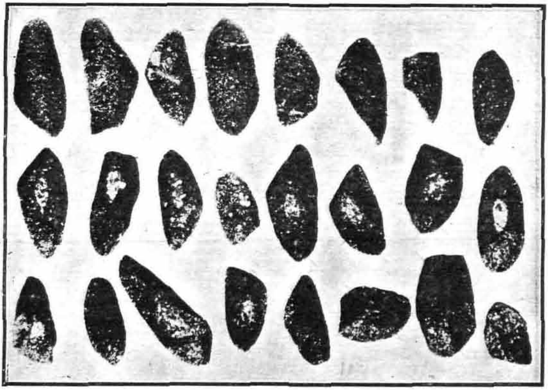
GREATER PLANTAIN (PLANTAGO MAJOR). ENLARGED 10 DIAMETERS.

RUGEL'S PLANTAIN.

Size: Very variable; average length, $\frac{1}{12}$ in.; average width, $\frac{1}{28}$ in.

Colour: Dark brown to black.

Shape: Very variable; resembles greater plantain very closely, although in general the seed is larger; oblong, and more or less flattened; often decidedly truncate; oval, rhomboidal, or triangular in outline. The outer surface is slightly rounded and often twisted.



RUGEL'S PLANTAIN (PLANTAGO RUGELII). ENLARGED 10 DIAMETERS.

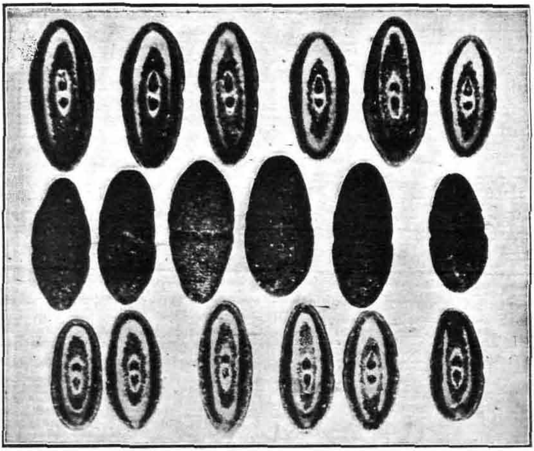
The inner surface is generally raised, but not so regularly as is that of greater plantain. About the middle of the inner surface is a well-marked whitish scar, but there is no small depression alongside this scar as in greater plantain. The edges of the seed are acute, and the seed is frequently acute-angled or sharply rounded at one or other of its ends. The surface of the seed is dull and rough, although not marked by raised lines as is greater plantain. The seed when wetted for some hours becomes enveloped in a thick coating of transparent mucilage.

BRACTED PLANTAIN.

Size: Average length, $\frac{1}{9}$ in.; average width, $\frac{1}{20}$ in.

Colour: A fairly uniform deep brown, sometimes dark brown, relieved on the inner surface by white markings.

Shape: Typically canoe-shaped; very regular; ends rounded alike. The walls are thinner than and not folded over as in rib-grass. The inner surface is much depressed, and bears in the



BRACTED PLANTAIN (PLANTAGO ARISTATA). ENLARGED 10 DIAMETERS.

middle a well-marked scar. This scar takes the form of two depressions in line with the long axis of the seed. The two depressions are divided off from each other, and are surrounded by a whitish border. *Right around the bottom, as it were, of* the canoe-shaped seed is a distinct white border. This white border really runs round the edge of the inner face, and is composed of mucilage-forming tissue, as is also the white border surrounding the scar. The walls of the canoe-shaped seed are apparently continuous, but at one end is a Y-shaped slit, dark in colour and seen at the

base of the convex face at one end. From the inner surface this slit is obscured by the white mucilage-forming tissue, but becomes evident after the seed has been wetted and the mucilage-forming tissue broken down. The outer face is distinctly convex, and is marked about its middle by a shallow groove extending right across the face from rim to rim at right angles to the longitudinal axis of the seed. The surface is in general dull and of a roughened granular appearance. The seed when moistened for a few hours becomes enveloped by a thick coating of transparent mucilage. The white markings on the inner face then disappear.

LARGE-LEAVED PLANTAIN.

Size: Average length, $\frac{1}{12}$ in.; average width, $\frac{1}{20}$ in.

Colour: Yellowish-green; dark green to black.

Shape: Very uniform; oblong and fairly flattened; both ends rounded alike; edges acute. The outer face is evenly convex, as is rib-grass, although not quite so rounded as is that seed; more rounded, however, than is either Rugel's or greater plantain. The inner face is flat, not raised or depressed, and bears in its centre a well-marked whitish scar, alongside of which is a small circular depression, both in line with the longitudinal axis of the seed. These two scars can be seen much more plainly when the seed has been wetted. The surface of the seed is dull and slightly roughened by minute sculpturing over the entire surface. The seed when wetted for some hours becomes enveloped by a thick coating of transparent mucilage.

SHORE PLANTAIN.

Size: Very small; average length, $\frac{1}{25}$ in.; average width, $\frac{1}{40}$ in.

Colour: Slatey; whitish around the margin.

Shape: Oval to obovate; both ends bluntly pointed, generally evenly so; edges fairly acute and in general lighter in colour than the rest of the seed. The outer face is convex, and turns upwards towards the ends like the bow of a canoe. Across the middle of this face of most of the seeds, and extending from rim to rim at right angles to the longitudinal axis of the seed, is a shallow groove similar in effect to that of bracted plantain. The inner face is raised in a convex fashion, and bears at its centre a very well-marked, deep, circular depression. The surface of the seed is dull and slightly roughened. The seed when wetted produces a copious supply of thin transparent mucilage.

LARGE-LEAVED PLANTAIN (PLANTAGO HIRTELLA). ENLARGED 10 DIAMETERS.

SHORE PLANTAIN (PLANTAGO CORONOPUS). ENLARGED 10 DIAMETERS.

The following table, compiled from analyses made in the Biological Laboratory, shows the relative frequency of occurrence of these seeds in the main agricultural seeds :—

Agricultural Seed in which found.	Of 100 Samples examined					
	Rib-grass was noted in	Greater Plantain was noted in	Rugel's Plantain was noted in	Bracted Plantain was noted in	Large-leaved Plantain was noted in	Shore Plantain was noted in
Perennial rye-grass ..	16	..	..	..	..	1
Italian rye-grass ..	20	1	..	..	..	..
Cocksfoot	26	..	..	..	..	1
Crested dogstail ..	30	3	..	..	..	..
Chewings fescue ..	5	..	..	..	..	1
Timothy	26	19	47	5	..	..
Fiorin	16	16	14	4	4	..
Meadow-foxtail ..	4	..	..	..	..	..
Meadow-fescue ..	7	..	2	64	..	..
Poa pratensis	33	3	..	..	..	..
White clover	85	28	2	..	..	..
Alsike	38	9	2	..	..	..
Cow-grass	93	3	2	1	..	..
Red clover	94	5	3	1	..	..
Lucerne	66	2	..	..	..	..
Lotus	72	8	..	..	..	..

Rib-grass was also noted in hard fescue, sand clover, Yorkshire fog, trefoil, sheep's fescue, ratstail, *Danthonia pilosa*, *Danthonia semiannularis*, kidney-vetch, phalaris, sheep's burnet, yarrow, crimson clover, *Poa trivialis*, *Poa nemoralis*, and strawberry clover.

Greater plantain was also noted in Canadian blue-grass, Yorkshire fog, and *Poa trivialis*.

FORTHCOMING AGRICULTURAL SHOWS.

Southland A. and P. Association: Winter Show at Invercargill, 16th to 19th May.
Raglan A. and P. Association: Winter Show at Raglan, 19th and 20th May.
Otago A. and P. Society: Winter Show at Dunedin, 30th May to 2nd June.
Waikato Winter Show Association: Show at Hamilton, 30th May to 3rd June.
Manawatu and West Coast A. and P. Association: Winter Show at Palmerston North, 20th to 23rd June.

A Blenheim correspondent inquires regarding the formation of a certain number of small or partial cobs among male flowers in maize experimental plots he is conducting. Bisexual tassels—*i.e.*, male inflorescences with a few female spikelets amongst them—are not infrequently met with. This is especially the case with those borne on sucker-shoots, which arise from the lower nodes or from beneath the soil-surface. Bisexual ears are also found, but these are much rarer.—*A.H.C.*

PAPA ROCK AS A SOIL-DRESSING.

THE following report on trials with crushed papa rock as a soil-dressing has been made by Mr. G. de S. Baylis, Fields Instructor (North Island). The trials were undertaken at the instance of the Dominion Conference of the Farmers' Union :—

With a view to making some trials as to the possible benefits to be derived from papa, samples were procured from various places. Analyses which were made by the Department's Chemist of many samples gave indifferent results, the lime-content being low and phosphoric acid only a trace. A sample was eventually procured from Mangaweka showing calcium carbonate 4·538 per cent. This was handy to the railway and at a convenient place for quarrying.

Considerable difficulty was experienced in getting anybody to grind the papa in order that it might be evenly distributed by means of a drill, and owing to breakdowns in the machinery it was very late in the season before the material was delivered.

At Ashhurst, on a clay loam with a stiff clay subsoil, the following trial was put in, with oats and vetches as the crop: Plot 1, 2 cwt. basic slag; plot 2, 2,000 lb. limestone; plot 3, nil; plot 4, 2 cwt. of a mixture of superphosphate, bonemeal, dried blood, sulphate of potash, and sulphate of ammonia. A strip across the top of each plot was dressed with papa at the rate of 8,000 lb. per acre.

Owing to very heavy rains in the early part of the season the crop did not do so well as it promised at first. There was, however, a superior growth on the portion to which papa had been applied. The best growth was made on the slag section. These plots are now to be put down in grass, and observation will show if any future benefit is derivable from the application of papa to this soil.

A sample of papa was obtained already ground from the brick-works at Patea, and forwarded to Mr. Blackhall, of Lepperton. This was applied at the rate of 4 tons per acre. A crop of swedes was sown with the usual freezing-works manure mixture. An equivalent area was also sown with the same manure on land not previously dressed with papa. Mr. Blackhall noticed no difference in the swede crop, "but the following crop for green manure," says Mr. Blackhall, "stood out with marked advantage in favour of the papa dressing, giving much heavier weight and being of a better colour. The soil to which papa had been applied was also, when ploughed, of a better texture than that of the 'nil' plot. I am of opinion that, provided one could apply, say, 6 tons of papa per acre, or more, it would give good results."

Last year ground papa was applied at the rate of 2 tons per acre to a small plot at Marton. The crop was Thousand-headed kale. The crop on the land dressed with papa was noticeably of a better colour than that on the no-lime plot, but the limed plots were superior to the crop on the papa plot.

It is hoped to pursue experiments with papa by treating a plot with a heavy dressing and leaving a check-plot alongside of it. A preliminary plot will then be grown to assist to mix the papa well with the soil, after which the land will be laid down in grass-and-clover mixture for observation purposes.

Although there are deposits of papa to be found having a fairly good lime-content, the average papa does not contain a high percentage. It would appear to me that to reap any real advantage papa would require to be heavily applied—say, in lots of 4 tons and considerably over. The cost of cartage and carriage would therefore prohibit its use, save where it is handy to the land to which it is to be applied.

The application of papa should improve the soil by its content of lime and what traces of phosphoric acid it possesses, and it should help, when applied in large quantities, to make the soil more absorbent and more retentive of moisture. It would probably need, like lime, to be applied some months before any real benefit would be likely to accrue from its use.

Lucerne usually does well on deep loams with rubbly papa subsoils, and where lime is not available a heavy dressing of papa, applied the previous season and well worked into the soil, would probably be found beneficial.

Papa might be quarried and left for twelve months in small heaps exposed to the atmosphere: it would then readily break up upon being applied to the soil. The better method, however, would be to apply it to grass lands, say, twelve months before same were ploughed.

Another use for papa would be as drier for manures. If ground into grit size like bonedust and then artificially dried, it would form a splendid make-weight or drier, and help to make the manure run better through the drill. When gypsum, which is largely used for this purpose, is high in price it is probable that papa artificially dried would answer the same purpose at probably a lower figure.

GATHERING WINE-GRAPES AT TE KAUWHATA HORTICULTURAL STATION.

WORK FOR THE COMING MONTH.

NEW ZEALAND is a country of wide variation in climatic and soil conditions. In applying suggested procedure it is, therefore, necessary for the farmer to amend it to suit local weather-conditions and the requirements of his soil—information which can best be ascertained by a study of these problems on the part of the farmer himself. Nothing can take the place of local knowledge. Little advice on an agricultural subject is capable of general application in its entirety.

THE FARM.

CULTIVATION.

DURING May favourable weather should be made the most of for further cultivating the land for winter wheat, and for the preliminary conditioning of the soil for spring-sown crops by ploughing. Heavy soils particularly are greatly benefited by exposure to the frosts of winter, the texture being improved considerably and the larvæ of destructive insects appreciably reduced. For spring-sown grains especially the fallowing of the land during the frosts of winter is particularly desirable, if not essential. The operation also conserves moisture, and this is important for districts of comparatively low rainfall.

TREATMENT OF WHEAT-SEED.

The procuring of good seed of a variety or varieties of wheat suitable to the soil and climate is important. Clean seed is particularly desirable, and for ensuring this the use of a fanning-mill should be availed of. To prevent bunt, or stinking-smut, of wheat the grain should be treated with formalin solution. There are two smuts that more commonly attack wheat — namely, the loose smut of wheat (and barley) (*Ustilago tritici*) and the stinking-smut, or bunt, of wheat (*Tilletia foetens*). For the former ordinary formalin and bluestone methods are not effective. The only effective method is what is known as Jensen's modified hot-water treatment, but, unfortunately, this is not practicable on a large scale. For stinking-smut of wheat (and for loose smut of oats) the formalin (a 40-per-cent. solution of commercial formaldehyde) treatment is considered the best. In Canada it has been tested fully, and

has given the best results of any of the various treatments tried. It is effective, handy, and cheap. The method consists of dissolving 1 lb. (1 pint) of formalin in 42 gallons of water, and immersing the sack of seed in the solution for twenty minutes. The operation is best performed by making use of a good-sized barrel, and a rope, connected with a pulley overhead, for suspending the grain in the solution. After immersion the grain should be rapidly dried on a clean floor, to avoid injury to the germinating-power. The smut balls, if any, should be skimmed off as they rise to the surface of the solution. Though this treatment is suitable for stinking-smut of wheat and loose smut of oats only, yet it should be used for all seed-wheat in preference to the bluestone treatment. Jensen's modified hot-water treatment cannot, for the reason indicated above, be recommended for use for large seedings, but for the production of a source of seed free from loose smut it is highly suitable.

WHEAT AND OAT VARIETIES.

In Canterbury and North Otago the following wheats have given a good account of themselves from the point of view of yield: Red Marvel (French), Dreadnought (French), Hunter's White, Velvet Ear, Velvet Chaff, Webb's Challenge, Talavera Tuscan, Red Chaff, Solid-straw Tuscan. For South Otago, Velvet Ear and Hunter's White are two very suitable varieties; while for the windswept areas of Canterbury and Marlborough the Tuscan varieties are specially suitable. Among other good varieties suitable for sowing in early winter in the South Island (especially in Canterbury) are Snowdrop White, Essex Conqueror Red, Kinver Red, Eclipse Red, and McCallum's Solid Straw.

The varieties of wheat mostly grown in the North Island are Marshall's White, White Tuscan, Solid-straw Tuscan, Federation, and John Brown. In the Rangitikei district Marshall's White was at one time the chief wheat, and is still fairly largely grown. There is a good deal of Federation also grown in the district. Tuscan wheat is largely grown in the Wairarapa.

The variety of oat mostly grown in the North Island is Algerian, on account of its rust-resistance. Green's Ruakura oat has made a reputation as a rust-resister and a good early cropper. Among other varieties grown in districts where rust is not so prevalent are Garton's, Sparrowbill Record, and White Ligowo. The latter is a special favourite in the Wairarapa. As an early forage crop, very good results have been obtained with this oat in Rangitikei, Manawatu, and Taranaki. In the South Island the oats chiefly grown

are Garton's, Sparrowbill, Leader, Record, Abundance, Yielder, and Waverley.

WINTER SOWING OF OATS.

The principle of sowing oats early and feeding them off is believed to enable the oat crop to ultimately resist rust to a degree, the explanation being that the crop, through advanced development, is better fortified against attack by rust - spores when they appear with warmer weather in the spring. Some farmers affirm that Algerians sown in May and fed back during winter are never affected by rust, although the straw is heavier and the oats are lighter in the chaff resulting from such crop; whereas spring-sown Algerians are more liable to rust, and will yield chaff containing less straw and more oats than autumn-sown crops.

POTATOES.

When digging the main crop of potatoes, which is usually lifted during the month of May, an endeavour should be made to select in the field, and not from the mass, seed for next year's crop. Sound, shapely tubers, about medium size, should be selected from the shaws yielding the largest number of potatoes. This can readily be done by keeping the shaws separate when digging, and placing in special sacks the selected potatoes taken from the prolific shaws.

Where potato-moth is present the tubers should be gathered and boiled for pig-feed. Where either potato-moth or Irish blight has attacked the potatoes all shaws should also be gathered and burned. In the event of growers being compelled to use seed from such crops (the practice is bad), the tubers should be treated with a weak solution of formalin.

PASTURES.

At this time of year pastures should be harrowed with a chain harrow or ordinary tine harrows turned upside down, for the purpose of scattering the droppings of manure, dragging out moss when present, and generally aerating the soil. The scattering of the manure aids materially in maintaining the proper balance between the coarse grasses and the finer grasses and clovers. Where the droppings of stock accumulate, the coarser, less nutritious grasses are encouraged.

LUCERNE.

In the milder sections of the country the last growth of the season of lucerne should be cut (not too closely), or fed off lightly.

Being too late to be made into hay, this last cut could be made into ensilage. Such lucerne chaffed with maize, if available, and blown into a silo, in the proportion of 1 part by weight of the former to 2 of the latter, makes a most excellent "balanced" ensilage. The late growth of lucerne may also be used for soiling, being fed out to stock as required.

LIMING.

The liming of lands in late autumn or early winter is desirable, in order that the lime may exert an appreciable action by the following spring. Grass land is greatly benefited by an application of lime. For sour soils well supplied with humus 1 ton per acre of ground burnt lime will be sufficient, while for sour soils not well supplied with humus 2 tons per acre of ground limestone (carbonate of lime)—which is the equivalent, approximately, of 1 ton of burnt lime — will be required. Where sour soils are situated a good distance from the railway the burnt lime is the most economical form to use; and where light sour soils obtain, small dressings (5 cwt. to 10 cwt. per acre) of ground burnt lime every three years should be used in preference to 1 ton per acre every five or six years. For cultivated land the lime is best applied half before ploughing and the other half on the ploughing, to be disked and harrowed in. If this method is not convenient the whole can be applied to the ploughing, and well disked and harrowed in.

COW-SHEDS AND YARDS.

If not already done, all material such as timber, gravel, cement, &c., required for repairing cow-sheds and yards should be got on the ground, so that the work may be put in hand immediately the bulk of the herd is dried off. The wet days of the month could be utilized at this work and for generally attending to the sanitary arrangements connected with the milking of the cows. The cow-sheds should be cleansed and whitewashed, the inclusion of a little crude carbolic in the whitewash being desirable for disinfecting purposes.

OTHER WORK.

The crutching of sheep should, if possible, be completed this month, and where foot-rot is prevalent the feet of the sheep affected should be attended to, and the flock grazed as far as possible on high ground or land that has been well drained.

The majority of farmers who are troubled with rabbits will have made an attempt during the past three months to reduce the pest by means of pollard poison, thus assisting to preserve their winter

feed. Where the work has been neglected it should be put in hand at once. It is bad policy to feed rabbits now and have your stock starve later. When poisoning choose dry weather, and do the work carefully and well.

When pressing work has been completed a general cleaning-up of paddocks, compatible with the labour available, should be carried out. Ditches overgrown with weeds should be cleaned out, rubbish removed from fence-corners and headlands, fences trimmed, and gorse and other rubbish grubbed.

THE ORCHARD.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

WITH the fall of the foliage commences the dormant season's work in the orchard. There are two main advantages of making an early start—firstly, in order to apply at the most beneficial time the autumn or early winter sprays; and, secondly, on account of the amount of general important work and numerous odd jobs to be done in the orchard during this period.

AUTUMN SPRAYING.

The main diseases requiring early attention are die-back of the peach (Clasterosporium), San Jose scale, and woolly aphis. Red-mite and the various scales and other diseases can be quite safely left until a little later in the season, when stronger mixtures can be more safely used for their control.

Die-back.—Clasterosporium is a fungus disease particularly affecting the peach and nectarine trees. The effects of the fungus are to be noticed in the form of brown spots of varying size on the previous year's wood, gumming buds, and dead twigs. The bark of the diseased twig within the affected area becomes corky and dry, failing to expand with the normal growth of the twig in the spring. When the affected spots are large or numerous the non-expansion of the bark results in the entire stoppage of the flow of sap and the death of the growths affected. It is from this characteristic of the disease that the common name of "die-back" originates. The bark of the diseased growths that survives the attacks invariably splits more or less to allow of expansion, the indication of which is often very noticeable on the older wood

of affected trees, and is often erroneously deemed to be bark-scorching as a result of using oil sprays. This disease becomes particularly active after the early winter rains, and is, together with a very dry summer, responsible for the heavy falling of the buds in the spring. The trouble is a difficult one to entirely eradicate, but a considerable amount of good will result from the application of a reliable fungicide applied sufficiently early in the season. The formula recommended for this purpose, in cases where die-back is the only disease to be considered, is 8-6-40 Bordeaux mixture; but if San Jose scale is also present, lime sulphur solution, 1 in 15, is advocated in preference.

San Jose Scale.—This very minute scale insect is extremely prolific and destructive, and for this reason every effort should be made to entirely eradicate it from the orchard. For this purpose very careful and thorough work is necessary, as the process of eradication has to be practically completed during one dormant season. It matters little how well the work may be done if it falls short of the complete extermination, for the insect, owing to the rapidity at which it multiplies, will still remain a serious consideration. This scale is, as far as actual killing is concerned, far more easily destroyed than either mussel scale or red mite, but it is far more destructive than either, as it is capable of destroying large portions of a tree in one season and wholly killing a tree in two seasons. Although the insects are sucking the life out of the tree throughout the summer, there is no doubt that the most vital period is from the time the sap of the tree ceases to flow until the scale becomes dormant. The reason of this is that during the growing season the roots supply a sufficient quantity of sap to keep the tree comparatively healthy despite the robbery carried on by the scale, but the moment this ceases the loss of sap becomes permanent and naturally much more dangerous. As a result, it is quite a common thing to find quite dead in the spring limbs which at the end of the growing season appeared to be comparatively healthy and well clothed in foliage.

During the height of the season there is little opportunity of adopting any very beneficial measures against this pest. There are several sprays that will destroy the young unprotected insect, but there are none having a lasting effect sufficient to destroy those that hatch out subsequently. At the same time the foliage of the tree will not withstand a mixture sufficiently strong to destroy the mature insects; therefore the proper time to commence operations is as soon as possible after the tree has reached the stage when comparatively strong mixtures can be used without damage.

Emulsified oil is no doubt the best remedy for this as well as other soft-bodied insects, but, especially in the respect of the peach and nectarine, strong oil sprays are very liable to damage the fruiting-wood when applied early whilst such growths are more or less immature. Lime-sulphur, although not equal to oil, is fairly effective and much safer to apply than oil at this stage; besides, lime-sulphur is a fungicide also, and for this purpose would take the place of Bordeaux mixture.

Woolly Aphis.—Summer treatment for woolly aphis is carried out mainly with the idea of keeping the disease within bounds until the stronger winter remedies can be applied. This is the utmost good that can be expected of the summer treatment, as the eradication of the aphis is a matter that can only be attended to properly when the trees are dormant. It will also, in order to be entirely successful, require a great amount of care and supervision, and is practicable only as far as trees up to a moderate size are concerned. This refers to painting the aphis colonies with strong oil emulsion, and to the renewal of treatment immediately a fresh outbreak is observed. Where practicable this is an excellent remedy, and one which, if regularly applied to young trees, would save much labour and trouble. In respect to large trees which have long been affected, the only practicable remedial treatment up to the present is that of spraying. To what extent spraying is successful depends mainly on the material used and the manner in which it is applied. Oil emulsion is now the recognized remedy for aphis, and owing to its value in this respect many varieties of apples can now be very successfully grown in localities where similar varieties had previously to be destroyed owing to attacks from aphis.

Although oil spraying is regularly adopted there is still a considerable difference of opinion in regard to the strength of mixture and the time of application. In this respect there has been a general tendency during the last few seasons towards increasing the strength very materially, particularly in spraying pip-fruits; but there are also undoubtedly many who still use the oil sprays at too weak a strength. Large numbers of growers strongly favour one thorough dressing of oil at the ratio of 1 in 8 to 1 in 12, applied when the trees are quite dormant, as being the most satisfactory all-round winter remedy for all sucking-insects. For the control of woolly aphis others particularly favour two applications of oil at a considerably reduced strength—1 in 25; the first application as soon as the foliage has sufficiently fallen to allow of thorough work being carried out, and the other just before the

buds burst. For general purposes I should recommend the single application, but there is no doubt that the double application has resulted very satisfactorily in the control of the aphis. The draw-back to this method, however, lies in the fact that the spray used is far too weak to give satisfaction with either mussel scale or red mite. If the second application was increased to 1 in 12 or 1 in 15 the main points of both ideas would be carried at the expense of a little more material on the one hand and labour on the other.

Summary.—To sum up, the sprays recommended for the control of the diseases mentioned are as follows :—

For die-back of the peach, spray with 8-6-40 Bordeaux mixture as soon as possible after the foliage has fallen.

For die-back of the peach and San Jose scale, spray with lime-sulphur solution at the rate of 1 in 15 as soon as possible after the foliage has fallen.

For woolly aphis spray with oil emulsion at the rate of 1 in 25 as soon as the foliage has fallen sufficiently to allow of the work being properly carried out.

PRUNING.

The pruning of stone-fruits will be well under way during May. Whether this should be done before or after spraying depends very much upon circumstances. There is no doubt that thinning out should be done only before spraying in respect to trees affected with diseases which multiply rapidly during the summer, such as San Jose scale. In this way practically all unshortened wood diseased when spraying would be cut away when subsequently pruned; whilst, on the other hand, the unsprayed tips—the weak spot with all sprayers—of pruned trees would still remain. Such unsprayed parts of an affected tree provide the main source of reinfection.

CULTIVATION.

The advantage to be derived from turning up the soil in the autumn for exposure throughout the winter is very great. Not only is the soil sweetened and altogether improved in this way, but provision is also made for the full advantage to be taken of the rainfall, whilst better provision is made for the drainage of surplus water. When ploughing at this season of the year the sod should be turned in towards the trees, leaving the finishing furrow between the rows. The ploughing of steep slopes or comparatively steep slopes, however, particularly when composed of

light soil, should be left till the spring, owing to the danger of such soils washing out seriously during heavy rains.

PLANTING.

Fruit-tree planting can be carried out during May where land has been properly prepared and is in suitable planting condition. Before planting all trees should be dipped in a barrel or other suitable receptacle containing a strong solution of emulsified oil, to ensure the destruction of the eggs of the red mite and other injurious insects.

THE POULTRY-RUN.

F. C. BROWN, Chief Poultry Instructor.

COLDS IN YOUNG STOCK.

Now is the time to keep a sharp lookout for colds in young stock—errors in housing and exposed quarters being the chief causes of this trouble. It should be remembered that colds are the forerunners of roup, and the sooner the cause is discovered and prevented the less risk there will be of the whole flock becoming affected. While the house should be roomy and well ventilated, every precaution must be taken to prevent draught. It is generally recognized that the deep open-front house is the ideal. It is imperative, however, that the slightest crack in the side or back walls should be repaired if colds are to be kept at bay. Where the house is a very long one the compartments—at least, every 20 ft.—should be made of some draught-proof material, otherwise a current of air will sweep along the building during rough weather, and the birds will probably become affected with colds. Another frequent cause of colds is having the perches too high from the floor. Especially does this apply where the breakwind or the boarded-up part at the front of the house is lower than the level of the perches. It will always be found that the lower the perches the greater the comfort of the birds during unfavourable weather-conditions.

The chief symptoms of colds are sneezing, eyes watering, and a watery discharge from the nostrils, on which dust adheres. In addition, the breath becomes offensive, and, when bordering on the stage of roup, one eye becomes swollen, and finally a cheese-like substance protrudes from it. While the fact cannot be empha-

sized too strongly that prevention is the best way of fighting this trouble, there are, however, remedies which will help to keep the colds in check. When fowls are observed to show any of the symptoms indicated, put half a teaspoonful of Condy's crystals into a pint bottle of water and add one dessertspoonful of the mixture to, say, two quarts of the drinking-water three times a week. Should this fail, take a saucer, a shallow dish, or similar vessel, fill it with pure kerosene, and dip the bird's beak into this sufficiently deep to cover the nostrils. Hold the bird in this position until it breathes; this will have the effect of drawing the kerosene to the seat of the trouble. Repeat the treatment on alternate days until a cure is effected. Care must be taken to give an ample supply of good grain food and green stuff, while grit and clean water should always be before the birds.

AGE DISTINCTION.

As it is practically impossible to distinguish between the hens and the pullets after the former get their new plumage, no time should be lost in marking the young birds. For this purpose a punch for marking the web of the feet can be obtained for 2s. Another reliable means of distinguishing the young stock is by using pig-rings. The cost of these is extremely low, and if properly put on (for which purpose a ringer is required) the birds seldom or never lose them. This cannot be said for many of the more expensive leg-bands on the market.

OVARIAN TROUBLES.

Many inquiries have already reached me this season as to ovarian troubles in pullets, the chief among these being protrusion of the oviduct. Very often this condition is due to constitutional weakness, some strains being more prone to it than others. Generally speaking, however, the trouble is brought about by oversupplying foods of a forcing nature, such as meat, or substitutes in the form of meatmeal or bonemeal. The desire to secure a big egg-yield now that the price of fresh eggs is ruling at a high level is leading many poultry-keepers to overforce their pullets, which is a very mistaken policy.

In order to obtain a good supply of eggs in winter, animal food is necessary, but there is a limit which cannot be safely overstepped. As to the correct amount to feed, local conditions must always be taken into consideration. When the pullets are just commencing to lay, for instance, these foods should be introduced by degrees until the birds become well developed and

settled down to their business. Again, when birds have free range and have thus an opportunity, especially after rain, of picking up insects, worms, &c., which has a forcing effect, meat materials must be sparingly fed. The same applies when large quantities of milk are given to drink. When these conditions are not fully considered, and the birds are given the usual amount of meat food recommended, the proceeding is practically inviting ovarian troubles.

If meat materials are fed separately, and the bird is given an opportunity of balancing its own ration, there is certainly less risk; but where boiled meat, and especially meatmeal or bloodmeal, is mixed with the mash and the same ration fed to all members of the flock where there is naturally a variation of egg-producing capacity, ovarian troubles will be rife in consequence. When boiled meat is available the ideal arrangement of feeding it separately is a simple matter; but in the case of substitutes this is not always practicable, owing very often to the birds refusing to eat it when placed in a separate hopper. When this is the case a small proportion of dry pollard and bran mixed with the nitrogenous material will often have the desired effect. Where the birds are enclosed in small runs and this handy meat-substitute is mixed in the mash it should never constitute more than 6 per cent. of the entire mixture. Of course, the foregoing does not mean that where only an odd bird or two becomes affected with an oviduct trouble the whole of the flock should have their forcing diet eliminated or reduced, thus bringing about a decline in the egg-yield; but if the trouble increases it is advisable to exercise caution and see that the proportion of nitrogenous matter is not provided in excess.

MISMANAGEMENT.

It is to be regretted more poultrymen do not realize that with poultry, as is the case of other classes of live-stock, half the breeding goes down the throat. It is not uncommon during my visits of instruction to hear breeders condemned and their stock pointed out as being inbred weeds or something to the same effect, such stock having often been produced from sittings of eggs, purchased as day-old chicks, or bred from birds supplied by a noted breeder. Complaints of the kind are sometimes justified, but in the majority of cases which I have an opportunity of investigating I find that the blame for the stock being undesirable is placed on the wrong shoulders. Instead of the specialists being at fault, the trouble is solely due to the person who makes the charges, on account of his own improper management.

Only the other day a case in point came under my notice. A number of miserable-looking half-grown pullets, six months old, produced from sittings of eggs supplied by a reliable breeder, were referred to by a poultry-keeper as weeds, owing to the fact that they were only half the size of his neighbour's pullets of the same breed and age. I soon discovered the cause. Not only had the mistake been made of rearing the little ones from a month old with the adult stock, but it was clearly seen that the starving process had been in operation. Apart from these adverse factors, the birds were confined in a small dirty run, which was not sufficiently large for half the number of stock. An examination of the house clearly indicated that the droppings had not been cleaned out for many a month, and, as could only be expected, the place was overrun with red mite. In these circumstances the young birds must have possessed a strong constitution to have even lived.

It is next to useless securing high-class stock from a specialist and expecting them to give a good return if they are not given an ample supply of food and kept under the most sanitary conditions possible. To be successful in poultry-keeping the person must have a natural love for his birds, and when this is present it will generally be found that not only are the best results obtained, but the business is made a pleasant undertaking. Unfortunately, however, there are too many people who apparently forget that fowls are living creatures. The way some flocks are neglected in regard to food and water, and compelled to roost in dirty vermin-infested quarters, is not only cruel to the birds but a disgrace to the people who own them.

THINGS TO REMEMBER.

One of the chief weaknesses in farm poultry-keeping is boarding too many old-age pensioners.

A good way to make sure there are no red mites about is to examine the perches at night.

Don't forget that a change of food or quarters will invariably cause the pullet to go into a moult at this season of the year.

Deep open-front houses, without draughts, containing ample litter for the birds to scratch in are essential to winter-egg production.

Fowls relish green food the whole year round. Remember, it reduces the grain account.

A hen when laying will eat much more than when she is not laying. When feeding poultry discretion should be exercised in this respect.

THE APIARY.

E. A. EARP, Apiary Instructor.

PREPARING THE CROP FOR MARKET.

THE matter of preparing the crop for local market or export must not be overlooked. It should weigh seriously with the producer. The requirements of the Sale of Food and Drugs Act cannot be ignored, and in time its provisions will eliminate old-style methods in handling honey. The law is framed to protect the purchaser against fraud and the honest producer against the unscrupulous trader. The regulations relating to honey provide that the bee-keeper must show plainly on the labels the contents and weight of the package, also his name and address. Do not label your honey " Pure Clover Honey " when you know distinctly that you are in a district where the bees are working on mixed flora. The correct description in such a case is " Pure Honey." See that all containers are clean (and free from rust in the case of tins) before filling, and secure tightly all lids before despatching to market. Remember that honey is an article of food, and should be treated with the care and cleanliness that other foods require.

SPARE SUPERS.

Where extracted combs have been placed on the hives for the bees to clean up, these should be removed and the bees confined to as small a space as possible consistent with the size of the colony. It may be necessary to leave some of the supers on during the winter months, and these can be dealt with in the spring. Do not leave the bees more space than they require, as it will be found that the bees will desert the lower ones and cluster on the top for warmth.

MATS.

See that each colony is provided with one or two good mats during the winter months, to keep the bees as warm as possible. Mats should be cut to fit exactly on top of the frames, and may be made from clean sacking or canvas. Sugar or corn sacks make excellent mats and are easily procured. Wood mats are adopted by some beekeepers, and, if desired, may be secured from dealers in bee material at a moderate cost. In districts where the bees do not bring in a great deal of propolis wood mats are effectual. On no account use calico mats, as these afford practically no warmth.

WEEDS.

Keep the hives clear of all weeds, so that the flying bees may have free access to the entrances. Many bees are lost in striking growing obstacles on returning to the hives. For the next few months, when the air is charged with moisture, it is important that plenty of air and as much sunlight as possible should penetrate beneath the bottom boards. In damp situations place the hives sufficiently high from the ground to avoid the dampness. Old bricks or concrete blocks make admirable supports for the bottom boards. Make sure that hives have sufficient cant towards the front before the winter rains set in. The presence of much moisture on the bottom boards will be the means of much loss to the beekeeper, and, in addition, cause the hives to become sour and foul-smelling.

SHELTER.

It is essential that suitable artificial shelter should be erected where the hives are exposed. Brood-rearing must be encouraged until a late date, and this will not be carried on by the bees if there is a lack of shelter. It is necessary to prevent the keen driving winds from gaining access to the hives, and the consequent bad effects of chilling the brood. In most districts there is an abundance of manuka scrub, and this affords capital shelter when erected in the form of a breakwind. On no account place hives under high evergreen trees with the idea of affording shelter. This is one of the worst locations, as the trees prevent the entrance of the sun's rays, and there is invariably a cold draught between the trunks.

CARE OF COMBS.

Good extracting-combs are the most valuable asset the beekeeper possesses next to his bees, and great care should be taken to secure them from the ravages of the wax-moth and mice. Hundreds of combs are destroyed annually through carelessness, and this can be prevented by attention to small details. Mice destroy the combs to gain access to the pollen and honey, and render the best combs foul and distasteful to the bees. Combs can be stacked in a mouse-proof room or in supers tiered one above the other. Queen-excluders may be utilized to keep mice out of the combs, and in the absence of close-fitting roofs are a complete success. If the presence of the wax-moth is detected the tiers of combs should be fumigated. Bisulphide of carbon is effective in destroying insect-life, but should be used with great care, as it is highly inflammable. Prevention is better than cure, and a few moth-balls placed in the supers will prevent the attack of the moths.

APIARY REGISTER.

A register for the purpose of keeping records of individual colonies will be of great assistance to the apiarist. If the apiary is to be conducted on commercial lines such a register will be indispensable as a complete record of the hive and its work, and will act as a guide to the beekeeper in laying out his plans for the forthcoming season. A record of the best queens and the average yield of each colony is important, more especially when working to improve the strain of bees kept.

THE FARM GARDEN.

W. H. TAYLOR, Manager, Arataki Horticultural Station.

VEGETABLE-CULTURE.

Peas.—In places where the soil is well drained peas may now be sown. Where the soil is extra dry in summer the resulting crop may be the best of the season, and this also applies to very hot districts. It is customary to sow only dwarf varieties at this season, but this need not be made a hard-and-fast rule. Dwarf kinds come into bearing earlier than other kinds because they have less growth to make before fruiting. In some parts the crop is a precarious one, a cold winter or a heavy rainfall causing slow growth, so that very little progress is made. In such cases it is wise to sow only dwarf sorts and only a small quantity. But where they are known to do well more should be sown and a taller kind also. A difficulty in some parts is the ravages of birds and slugs. It is a hard matter to rid the garden of slugs in winter when there is frequent rain, and birds are a still greater difficulty. Both slugs and birds may be overcome by putting sticks to the peas. Birds seldom trouble them when so protected, and slugs do serious harm only when the haulm lies on the ground. If the haulm is clear of the ground a sprinkling of lime and soot occasionally is sufficient protection and, further, acts as a fertilizer. I always sprinkle a little soot over the peas before covering them with soil. It protects them from all insect pests while in the early stages of growth, and the manurial effects of the soot is seen in the rich green foliage and strength of growth.

Broad beans may be sown anywhere. The plant is a hardy one that grows well during winter. Beans do not form till there is a certain degree of warmth in soil and atmosphere; therefore the haulm may run up too tall. In summer it is best to top

the plants when about a foot high. It would not be wise to do so in winter, as it would at that time delay the crop. When it is seen that the pods are holding, the tops may be pinched off if the haulm is getting very tall.

Rhubarb.—If the clumps of the summer varieties stool out freely they become, after two or three years, very weak in the centre. It is advisable on that account to lift the roots every three years or so. As they are now dormant, they may be lifted at once if it is desired to work up the ground. The clumps may be piled in a stack in any convenient place in the open—the weather will not hurt them. Replanting should be done just as soon as they show signs of growing in the spring. The clumps are then to be chopped up with a sharp spade. Plant back strong pieces from the outside of the clumps—one to three good crowns should be taken for each new set.

Winter rhubarb is best renewed by seed sown at any time except winter. Present beds, if they have been manured fairly, will be benefited by occasional dressings of nitrate of soda. Give 2 oz. per square yard at about four weeks' interval. It is not good economy to give heavy dressings, as nitrate of soda is very soluble in water, and what the plants do not absorb quickly is washed away.

Seakale should be cleared of the old leaves, weeds, and other rubbish, and the soil forked over. Do not dig deeply; it is unnecessary and would cut the roots. Crowns that are strong enough may be forced at any time during the dormant season. What is necessary for covering them depends on the size of the clumps. In Europe earthen pots are made for the purpose; we have to use what we can get. If the clumps are small, kerosene-tins will answer. Both ends must be cut out; the open end at the top can be covered with pieces of board. The whole should be surrounded by fermenting manure; a covering about a foot thick all round—that is, a foot through to the box on all sides as well as the top, which means nearly a yard through all—will provide sufficient heat. Cover only a few clumps at a time, for seakale quickly spoils. It takes about a fortnight to force. If the kale has not all been forced before natural growth begins it will be sufficient to cover the remaining clumps with tins or boxes, not using manure. All crevices must be stopped up to secure perfect darkness inside, or the process will be useless. I have read of the clumps being ridged over with earth when the crowns break up into the soil and so becoming blanched. I never succeeded, however, in getting good stuff that way. It may answer in a dry climate.

Spinach from recent sowings should be growing freely. Thin the plants so that they stand singly at least 8 in. apart. Be careful not to leave two plants in a place instead of one—a very easy matter. The plants do not grow freely unless they each have plenty of room for their roots.

Turnips sown recently will stand through the winter. Timely thinning promotes good growth, and is easiest. Broad lines are the most profitable; excessive thinning is not required. If the seed was thinly sown, very little thinning is required. The capability of a bed for production is enormously increased if a little trouble is taken, when pulling for use, to take always the most forward. Such is the way with growers for market, who seek to produce a large number of medium-sized bulbs with the least possible expenditure of labour and space.

Cultivation.—In summer-time a fine surface kept loose is the order, as it conserves moisture, while allowing a proper ingress of air. During winter it is better to leave the surface in a rough state, by which means a greater surface of soil is exposed to the beneficial effects of sun and wind. Soil that might be heavy and sour with a loose surface may be kept sweet and friable if dug up and left rough. Vacant plots should be so treated. This method of cultivation refers to the surface only. Lumps below the surface should be broken up, or they will remain lumps, which will become very hard in summer. This should be kept in mind when trenching ground. If lumps are left unbroken it will be hard to get good crops.

SMALL FRUITS.

Strawberries.—Where leaf-blight has been troublesome, means should be taken to destroy as much of the foliage as possible. The most simple plan is to mow the foliage with a scythe, let it wither, and then set fire to it. Where a mulch of littery stuff has been employed its remains will help the burning. If necessary, dry straw may be littered over the bed to assist the burn. The straw will not be wasted, as the resulting potash will benefit the plants.

Black Currants.—Black currants will not succeed on dry soil. It is useless to plant them on such places. A fairly strong rich soil is best, but, above all, a moist subsoil is necessary. The mode of pruning should vary according to locality and climate. In all but the coldest parts of the Dominion there is trouble with the borer. In some parts the black currant was thrown out of cultivation because of the destruction wrought by borers. That is, however, not necessary. Where there is but slight trouble

from the borer the English method of training and pruning should be adopted. This is the same as for the red and the white currant. A framework of branches is trained up in the form of a cup, and all side shoots are reduced to short spurs. When this style of bush is adopted care must be taken not to allow suckers to come up. Where the borer is troublesome a different plan must be adopted to ensure success. Non-suckering bushes are secured by carefully cutting out all buds on the cuttings that are to make the bushes, except four or five at the top that are required to make the branches. When this is carefully done and good long cuttings are put in, suckering will not take place to any extent. When a stooling bush is required none of the buds should be cut out. The object is to allow the underground shoots to come up to a sufficient extent to ensure a constant supply of them in various stages of development. A young branch is seldom, perhaps never, lost through the borer. It is old stems that are attacked, or perhaps they are old before they become seriously injured. The management of the bush consists in so working up young branches from suckers that the older may be cut out before they are enfeebled by the work of borers. The black currant bears fruit on wood of the preceding year, so that the frequent renewal of wood does not lead to loss of fruit. This style of bush is pruned quite differently to the one first mentioned. Fruit being taken from young shoots as well as from spurs, and a sufficient number of such shoots being annually left to furnish the bush without crowding, it will not be cup-shaped, but have a full centre. Young shoots left for bearing should be shortened a little, merely nipping off 3 in. or 4 in. of the tips, fruit-buds being wanting or but feeble in that position.

Cape Gooseberries.—Growers should sow seed now in preference to waiting till spring. Sow in boxes, prick off as soon as large enough into other boxes, and keep them just growing till spring. These make strong, hardy plants that will make much greater early growth than spring-sown plants, and give much better crops the first year.

Gooseberries, red currants, &c., will be dealt with in the next issue of the *Journal.*

THE FLOWER-GARDEN.

Roses.—Transplanting roses can be successfully done at any time after cool weather sets in until growth becomes active in spring. There is a period of from sixteen to eighteen weeks available for this work, beginning about mid-April. If everything is ready the best time is from the middle of April to the middle

of May. Planted at the time stated the foliage is still active, so that new roots are quickly formed and the bushes are re-established before they go to rest. Naturally the bushes start stronger in spring than they would if only then planted. Bushes transplanted in the autumn should not be pruned at that time—the growth is wanted to promote root action; but it may be wise to cut back tall shoots somewhat, just enough to take away some top hamper, so that the bushes may stand firm. There is no need to try to lift soil with the roots; it is usually impossible, and is not required; nor is there any occasion to lift long roots. Dig straight down about 12 in. from the stem, cutting through any roots the spade may meet. All broken or cut roots should be cut again by knife or seccateurs; unless cut with a clean cut they are likely to die back for some distance, greatly impairing the root-system of the bush. For planting, a hole should be made wide enough to allow the roots to be spread, and a little deeper than the length the roots will be left. Stand the bush in its place and fill the hole about two-thirds full with soil. Shake the bush so as to distribute the soil among the roots, and at the same time lift it a little. The roots will then be placed. Now tread the soil very firmly over the roots, and finish by filling up the hole with loose soil, leaving it in that state. It is highly important that the soil be trodden very firmly about the roots, also that the surface soil be left loose so as to allow the free passage of rain and to prevent caking.

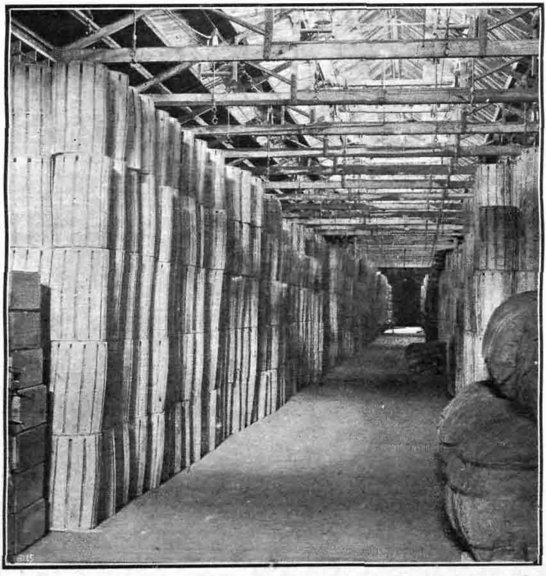
Rose-bushes should not be allowed to send up suckers. When suckers are allowed to grow it is very difficult to control the bush. Some of the suckers are sure to be extra strong and dominate the rest of the growths, which become weak, and the bush then becomes difficult to manage and altogether unsatisfactory. This refers to bushes growing on their own roots. Budded bushes, of course, only throw stock suckers, unless they have been planted too deep. If suckering is troublesome the only way to subdue the trouble is by lifting the bush. All the suckering roots and all underground branches should be cut off. A single stem only should be allowed, and branching should occur well clear of the ground.

Rose-bushes at times become overgrown and comparatively flowerless. In such cases transplanting is the remedy. Cut the roots well back, thin out the shoots, and when the bushes become again established prune severely. The latter remarks apply mostly to hybrid perpetuals, which are the offenders in this respect. Pruning should be done in June or July. Flowerless growths in other sections are usually the result of bad pruning. The pruning of roses will be dealt with in the next issue of the *Journal.*

Primroses and all the family may be planted now. *Violets* can be planted now, but it should be done only as a matter of

convenience. They are best planted immediately after flowering. They never flower well the following spring if planted in autumn.

Transplanting.—All kinds of shrubs and trees as well as most perennial plants may now be transplanted. In most places autumn planting is best, because, as they get a new roothold at once, they make growth in spring. Local conditions must rule this question. Where the soil becomes waterlogged in winter and early spring, planting should not be done until that condition is past. Early summer is the best time to plant in some places. It has been my experience to deal with places where October was the best month for planting. In such cases growth is made the following autumn.



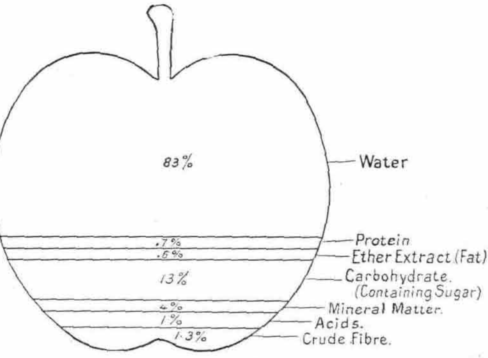
SIXTEEN THOUSAND CRATES OF CHEESE AT WHARF, WELLINGTON.
The photograph was taken just prior to loading of shipment.

ALL ABOUT AN APPLE.

H. BENJAFIELD, M.B., in the "Fruit World of Australasia."

As both food and medicine an apple is a wonderful example. Professor McAlpine gives us the accompanying diagram, of which the following is an explanation in plain English. Suppose this apple to be the size of a large breakfast-cup, and into this cup you put nearly half a pint of water, and stir into it—of concentrated food like that contained in an egg, half a teaspoonful; of fatty stuff like butter, a little less than half a teaspoonful; of sugars, both cane and grape sugar, two tablespoonfuls; of mineral matter, as much as will lie on a sixpence; of acids, a little more than half a teaspoonful; of skin and core, about two-thirds of a teaspoonful.

From a medical point of view we look upon each of these elements as follows: The food, or protein, is pure and strengthening, and exists in the apple combined



with sugars and acids, and when taken enters rapidly into the muscles, where it is readily broken up, imparting heat and strength, so that the athlete unde great exertion soon gets the stimulus.

The fatty matters are so combined with acids that even the most delicat child does not recognize that he is taking fat when he is eating an apple.

The sugars, or carbohydrates, form the most attractive as they are the mos nourishing part of the fruit. And these sugars are just crystallized sunshine and are far more digestible than any ordinary sugar. The child from babyhoo just loves it, and it is excellent food for him. In the adult, especially in advance age, ordinary chemically prepared sugar when taken freely produces rheumatism gout, and suchlike diseases, but these sugars never set up any of these troubles indeed, gouty people get relief from fruit.

The mineral matter in the apple is one of Nature's wonders. The blood must keep its red colour or it cannot do its work in the body, and we die. When we eat an apple we take just the right dose of iron which the blood needs, and the invalid with poor blood will get iron in the apple which is far more easily absorbed by the blood than is any preparation of iron compounded by the chemist. Lime is found in the apple, in the same form as it is found in our bones, and in the apple the lime is so beautifully combined with phosphoric acid that when an apple is eaten the bones of the body are nourished by these lime salts, and by these additions of lime the child is able to build up the young growing bone. Rickety children have bones deficient in lime. I have never seen rickets or soft bones in a Tasmanian orchard.

Magnesia! Yes, Nature has placed in the apple quite a nice little dose of magnesia, and it helps to keep off rheumatism by purifying the blood and assisting the bowels.

Phosphorus: Professor Schaffer told us recently in the great scientific lecture of the year that life could not exist without phosphorus, and in the apple this great nerve-tonic exists in quite a full dose, and it exists in its most soluble form as phosphoric acid.

Sulphur, as sulphuric acid, is also a great blood-purifier, and has an especial effect on blood and skin diseases.

There is just one more thing which science has not yet explained, and that is the wonderful life processes by which all these tasteless elements were blended together into a beautiful fruit and a perfect food.

The bee loves honey because its nature cries for a perfect food, and for the same reason the child cries for an apple, which will help its digestion, will make its blood richer, will strengthen its muscles, and stimulate and feed its brain and nerves. The sailor fed on salt meat and biscuit dreams of an apple as he is dying of scurvy, and our soldiers write me from the trenches that an apple a day would greatly help them with their bully-beef-and-biscuit diet.

PATRIOTIC NATIONAL APPLE SHOW.

EVERY New Zealand fruitgrower should carefully consider the claims of the Patriotic National Apple Show, to be held in Wellington from the 8th to the 13th May, with a view to supporting the movement to the best of his ability. The show has for its object the double purpose of bringing the New-Zealand-grown apple before the public and the raising of a fund by the sale of gift fruit for patriotic purposes in connection with the war. The first object is of prime importance to the fruitgrower, while the laudable nature of the second is in itself sufficient to ensure the general and hearty support of those in a position to do so. A large list of exhibition classes has been arranged for, as indicated by the official schedule of exhibits, copies of which have been largely distributed. In addition, consignments of fruit for patriotic sale will be welcomed by the show officials. Arrangements have been made to receive and have all fruit forwarded to the show either for exhibition or for sale. Consignments should be forwarded addressed to T. C. Webb, Secretary, National Patriotic Apple Show, Wellington, in ample time to allow of proper arrangement before the opening of the show. The show is being held under the auspices of the New Zealand Fruitgrowers' Federation (Mr. J. Longton, managing director), assisted by the Committee of the Wellington-Moutere Fruitgrowers' Association, with Mr. T. C. Webb, Orchard Instructor, Wellington, acting as honorary secretary.

Writing on 8th February, the High Commissioner mentions that the prices then ruling on the market for wool were higher than they had ever been since the London wool auction sales in Coleman Street were inaugurated.

ANSWERS TO CORRESPONDENTS.

IN every instance a question to which an answer is desired in these columns must be accompanied by the full name and the postal address of the inquirer, not necessarily for publication, but as a guarantee of good faith. The question should be written on one side of the paper only.

PALISADE-WORM IN HORSE.

H. ASHWORTH, Kohekohe :—

I have a horse that is troubled with a little red worm about ¾ in. long. He passes a few every day. He is scoury, weak, and thin. Are these worms only in the digestive tract? What treatment would you advise? The horse is a light draught, about twelve years old.

The Live-stock Division :—

Your horse appears to be infested by the worm known as *Sclerostomum equinium*, or palisade-worm. It is a very dangerous parasite to horses. The embryos sometimes are found to invade the larger blood-vessels, giving rise to thrombosis and frequently setting up attacks of colic. The adult worms inhabit the intestines and are very difficult to get rid of. Horses infested in this manner are constantly infecting the paddocks with the eggs of these worms passed out in the dung, and thus reinfection of the animal is constantly taking place by means of the food and water-supply. Affected animals should be moved to different pastures, and old pastures should be ploughed and cropped before being laid down in grass again. Efficient drainage, and top-dressing with lime, are also remedies which suggest themselves. Individual treatment of cases is best carried out by the administration on a fasting stomach of 1 dram of thymol dissolved in a pint of linseed-oil, for horses, or 13 grains of thymol for foals. Good quality of foodstuffs in ample quantity must be given to animals suffering from the effect of parasitism in any form. Improvement in the condition of the subject is more important than medicinal remedies.

GRASSING DRAINED PEAT SWAMP.

"SETTLER," Dargaville :—

Will you kindly advise me of a suitable mixture of grasses and suitable manure to surface-sow on drained peat swamp? Scrub and rushes have been burnt off, and the swamp is sufficiently consolidated to carry young cattle or sheep, but will not stand horses, so that it is impossible yet to cultivate it.

The Fields Division :—

If you have sufficiently drained the land top-dress it with at least 1 ton of ground burnt lime per acre. As manure, after satisfactory drainage, you could use the following (all quantities being per acre): Basic slag, 3 cwt. (*or* Egyptian basic phosphate, 3 cwt., *or* basic superphosphate, 3 cwt.), and 2 cwt. to 4 cwt. kainit (*or* 1 cwt. muriate of potash, *or* 3 cwt. to 5 cwt. wood-ashes). The following grass mixture should give you satisfactory results after such treatment: Timothy, 4 lb.; meadow-foxtail, 6 lb.; cocksfoot, 7 lb.; Italian rye, 5 lb.; red-top, 1 lb.; alsike, 2 lb.; cow-grass, 2 lb.; *Lotus major*, 1 lb.: total, 28 lb. per acre. Sow only clean seed of good vitality.

SODA-BLUESTONE SPRAYING-COMPOUND.

W. H. THOMPSON, Reefton :—

Regarding the substitution of washing-soda for roche-lime in Bordeaux mixture, as recommended by the Department for spraying potatoes, can this same compound (bluestone and washing-soda) be applied in winter to fruit-trees for black-spot, peach leaf-curl, and as a fungicide generally ?

The Horticulture Division :—

The mixture prepared with washing-soda may be used in all cases of fruit-tree spraying for which Bordeaux mixture is used, but the lime is the most popular. In using the soda-bluestone mixture for summer spraying it is advisable to test carefully with litmus in order to as far as possible avoid scorching, which is the greatest drawback to the use of this mixture.

VENTILATION OF DAIRY.

A. D., Ouruhia :—

Would you kindly let me know the best means for ventilating a small dairy ? We get wind and dust very badly. The dairy is about 7 ft. square, under tank-stand. I had one in the same position before, but had to stop up all ventilation on account of dust.

The Dairy Division :—

Good ventilation can be obtained by constructing two air-shafts in opposite walls of the building, between the weatherboards and inside lining. The one for the intake of air should be 8 in. by 4 in. and, say, 4 ft. 6 in. in height, with an opening at the base to the outside wall and a similar opening for the inside at the top. The other shaft should extend from near the floor to the top of the roof, and have the bottom opening inside the building, and the one at the top to the outside air. To prevent dust passing into the dairy the inner opening on the shorter shaft may be covered with a double thickness of buttercloth. Hinged covers may also be fitted to regulate the draught. All joints in the air-vents should be made tight in order to prevent counter-draughts.

WIND TROUBLE IN HORSE.

"HORSE," Henderson :—

We have a mare that developed a cold, with a thick whitish discharge from the nose running constantly, also a violent cough. Sometimes the cough seemed to almost shake her to pieces. One day blood was mixed with the nasal discharge. We gave her a spell and applied a steam bath to the head. She is now apparently all right, has regained her condition and somewhat of her former spirits, but seems to have lost her wind-powers. What is the best remedy to use in the circumstances ?

Live-stock Division :—

The severe catarrhal trouble from which your mare has suffered seems to have affected her constitutionally, and she may now have contracted that form of unsoundness known as "broken wind." We would recommend you to give a little linseed mash—not more than 1 lb. per day—in the feed, and try the effect of the following mixture, giving two wineglassfuls in the food or drinking-water three times daily : Extract of belladona 2½ drams, bicarbonate of soda 2½ oz., Fowler's solution of arsenic 5 oz., water up to 1 pint.

INFECTION THROUGH FOAL'S NAVEL.

'SUBSCRIBER," Mayfield :—

Some time ago a foal a month old became lame in one of its hind fetlocks. At the end of two days it became lame in the opposite front fetlock also, and appeared to be in pain. I bathed its legs, which seemed to relieve it, but on the

fourth morning its joints were swollen. I gave it castor-oil, but it grew worse during the day and died that night. From what I can gather it died from a disease contracted through the navel. If that is so, is there a cure or preventive?

The Live-stock Division :—

Your opinion that infection had proceeded by way of the navel is probably quite correct. Wherever trouble of this nature is known to occur it is a wise plan to paint the navels of newly-born foals with a little tincture of iodine. This simple procedure is of great value in preventing infection from source in question.

LIMING GUM LAND.

"INQUIRER," Albany :—

I have a paddock of gum land which I intend to plough this autumn, allow to fallow till next autumn, and then put in grass. I intend to give it a dressing of lime. Would it be advisable to put the lime on this winter, or next autumn immediately before sowing the grass-seed?

The Fields Division :—

It would be preferable to put half the lime on the ploughing this coming early winter and disk in somewhat, and the other half next spring, disking in well and tine-harrowing. The soil should be in good shape from the point of view of lime-improvement by next autumn when you work up the ground by ploughing, disking, tine-harrowing, and rolling for the grass-seed sowing. Use 15 cwt. ground burnt lime or 1 ton ground limestone per acre at each liming.

HEDGE FOR ROAD-LINE.

"SUBSCRIBER," Auckland :—

Will you be good enough to tell me what would be a good suitable hedge to plant along a wire fence on a main road? I want the hedge to cover the wire eventually. The soil is loose with a good subsoil. The situation is exposed to rather strong winds, but the hedge would be sheltered by a belt of lopantha. *Pittosporum crassifolium* has been suggested.

The Horticulture Division :—

Pittosporum crassifolium would no doubt suit your purpose very well. It makes a capital hedge when planted closely—not more than 18 in. apart—and well and regularly cut. Barberry, eleagnus, or broad-leaf privet should also be suitable.

CROPPING QUESTIONS.

W. H. J. H., Otaki :—

1. I have a paddock of about 12 acres which has for a number of years been down in grass. Last year the paddock was ploughed and sown with oats, a fair crop resulting. I wish to put it down again in grass. Would it be advisable to put it in rape, and after feeding this off with sheep to lay it down in grass? The soil is light loam with a tendency to get dry at the latter end of summer. I shall be glad to have advice regarding manuring and the varieties to sow.

2. I wish to grow tares for seed. When is the best time to sow, and is it advisable to feed off the first growth and let the second go to seed?

The Fields Division :—

1. The soil being light loam and inclined to become dry in late summer, it would probably not be strong enough to grow a crop of rape before seeding to grass. We would advise your sowing the grass mixture in the spring with a lightish seeding (broadcast) of soft turnips—say, Imperial Green Globe variety. As an alternative you could sow the grass with 1 to 1½ bushels per acre of Black Hulless barley and feed off the latter periodically, but not closely, as the young grass may be injured by close feeding. As manure use 1½ cwt. basic superphosphate and 1½ cwt. blood-and-bone manure per acre. The following grass mixture should

suit your soil-conditions: Cocksfoot, 6 lb.; Italian rye, 4 lb.; perennial rye, 5 lb.; crested dogstail, 2 lb.; *Poa trivialis*, 3 lb.; hard fescue, 2 lb.; cow-grass, 2 lb.; white clover, 1½ lb.; *Lotus corniculatus*, ½ lb.: total, 26 lb. per acre.

2. Tares or vetches are best sown in the spring (October) and harvested in the early autumn. It would be preferable not to feed off before allowing to go for seed, but, if done, feed off fairly early and lightly, and then let the crop mature.

MORTALITY AMONG SUCKING-PIGS.

X.Y., Avondale:—

Can you advise me regarding a sickness that is taking off my sucking-pigs? They appear quite healthy and doing well until seized with a kind of fit, which passes off in a few minutes, leaving them twitching or shivering. In the interval between the fits they frequently run about, but appear not to know where they are. Some become weak in the back, and lose use of legs and die. The largest and strongest are taken first; the small ones seem healthy and still live.

The Live-stock Division:—

This complaint in your young pigs is due to an alteration in the sow's milk, brought about probably through digestive troubles. The remedy would be to treat the sow by administering a dose of 5 oz. or 6 oz. of castor-oil. An alteration in the sow's feeding would also be beneficial.

TREATMENT OF FOOT-ROT.

"NOVICE," Tuatapere, Southland:—

On account of wet season and soft grass my sheep are very much troubled with foot-rot; even some of the lambs are affected. I have tried hand dressing with bluestone and Stockholm tar, also bluestone liquid in troughs, with little result. Any advice would be very much appreciated.

The Live-stock Division:—

As you appear able to treat the cases of foot-rot individually, we would suggest that the affected sheep and lambs have their feet trimmed in the usual manner, and that tincture of iodine be applied with a stiff brush. This treatment should be carried out twice a week.

DESTROYING FAIRY-RINGS.

W. CHARMAN, Lower Manaia, Masterton:—

I have a piece of land of good quality, although fairly dry, which is infected with a fungus growing in rings of about 6 ft. in diameter. The fungus seems to absorb every particle of moisture within the ring and the grass dies right out. Could you suggest any top-dressing likely to be beneficial in eradicating the pest?

The Fields Division:—

The only direct method of destroying fairy-rings that has proved successful —though costly for agricultural purposes—is to water the ground with ferrous sulphate solution, 8 lb. dissolved in 50 gallons of water being applied to each 60 square yards. The application is repeated about four times at intervals of one week, and then ground burnt lime is applied at the rate of 1 ton per acre.

RECLAIMING MANGROVE SWAMPS.

"INQUIRER," Russell:—

Could you tell me whether it is possible to successfully drain and grass mangrove swamps which are covered with a growth of small and large mangrove-trees, and which are always flooded from 6 in. to 24 in. with the rising tide? The intention is to construct a dyke just above low-water mark, right through the mangroves, enclosing everything, with flood-gates at intervals to prevent the

rising tide from getting in, and to let out surface water; also to construct a drain all round the foothills to carry away hill-water. Would this be a suitable method? If it can be done, at what length of time after draining would it be possible to grass it? What grasses would be suitable? Would it be necessary to break it up, or would surface sowing do? The flooded area is composed of very sticky, deep mud, and the part bordering the hills looks to be composed of decayed vegetable matter covered for the most part with rushes.

The Fields Division :—

As to whether successful drainage and grassing of mangrove swamps can be effected is primarily an engineering problem, and this would be required to be determined on the spot by an expert. Once it is drained, however, the dried mud could be treated with gypsum to remove brackishness to a large extent, and grasses suited to brackish marshes could be planted out from nurseries established on special portions of the areas. The following grasses should serve their purpose: Salt reed-grass (*Spartina polystachya*), rush salt-grass (*Spartina juncea*), salt marsh-grass (*Spartina stricta*), found thriving from Pennsylvania southwards in North America; rough marsh-grass (*Spartina glabra*), found thriving from New England southwards in North America; smooth marsh-grass (*Spartina alterniflora*), black-grass (*Juncus bulbosus*), goose-grass (*Glyceria maritima*). Seed of these grasses does not appear to be stocked by American seed firms. You may, however, obtain them through a firm such as Thorburn and Co., 33 Barclay Street, New York, or, failing this, through the Bureau of Plant Industry, United States Department of Agriculture, Washington, D.C. The seed, of course would have to be specially gathered.

TREATING SCALD IN SHEEP.

"SUBSCRIBER," Okaiawa :—

I have a number of sheep badly affected with scald in the feet. The foot itself is quite sound, but the trouble is between the claws. I would be obliged if you could suggest a cure.

The Live-stock Division :—

Keep the space between the claws clean, and wash away any accumulated matter. Then get a stiff paint-brush and apply tincture of iodine, 1 part to 1[illegible] parts of water. If a very large number of sheep are affected a trough will have to be constructed to contain a 4-per-cent. solution of creolin, and the sheep must then be driven through this.

SETTING OF LEMON-FRUIT.

W. E. RIDDLE, Foxton :—

What is the cause of fruit not setting on lemon-trees? The trees in questio[n] are young and look well in their foliage; the blooms come and appear to se[t] then shortly after fall off.

The Horticulture Division :—

Unsuitable climatic conditions are probably the cause of your lemons failin[g] to set fruit. Lemons when grown under more or less severe weather-conditio[ns] rarely set fruit satisfactorily, particularly when young. When, however, su[ch] conditions are not excessive, an improvement may be expected as the tre[es] mature, provided the variety is a reliable one.

SHELTER-BELT.

"ENGINEER," Mangere :—

I have a farm at Mangere running right down to the beach (Manuk[au] Harbour). It is absolutely open to all westerly winds, consequently very c[old] in winter. Will you kindly advise me the best shelter-trees to plant, and wh[at] time to put them in?

The Horticulture Division :—

We would advise you to plant Lombardy poplar at a distance of about 2[...] apart. Use either good stout cuttings or rooted plants. Prepare the soil w[ell] before planting, and keep it worked around the plants for a few seasons. Plant[ing] may be done at any time during the dormant season.

COMMERCIAL INTELLIGENCE.

MEAT-FREEZING WORKS.

Since the publication of the list of New Zealand meat-freezing works in the last issue of the *Journal* the works of the Oroua and West Coast Meat-freezing Company (Limited), at Aorangi, near Feilding, have been completed and have commenced operations. These works have a killing-capacity of 100 cattle and 2,200 sheep per day, and cold-storage space equivalent to 70,000 carcases of mutton. The works of the Westfield Freezing Company (Limited), at Westfield, near Auckland, are expected to be completed and in operation about the middle of May. The slaughtering-capacity of the works will be 200 cattle and 3,000 sheep daily, with cold storage equal to 175,000 mutton carcases.

Including the two establishments just referred to, the total capacity of the meat-freezing works in New Zealand is shown to be as follows: Sheep-slaughtering, 109,650 head per day; beef-slaughtering, 3,085 head per day; cold storage, 3,516,450 60 lb. carcases of mutton.

The list of meat-freezing works published in the February issue was inadvertently given as at March, 1915. This, of course, should have been 1916.

IMPORTATION OF SALTPETRE FROM INDIA.

The Government has received a cablegram from the Indian Government to the effect that exports of refined saltpetre from India for meat-curing purposes can be permitted only on receipt of applications from the New Zealand Government. Merchants who may therefore desire at any time to import saltpetre from India should communicate with the Secretary, Department of Agriculture, Industries, and Commerce, Wellington, stating names of shippers in India, quantities of saltpetre required, and refraction. The exportation of crude saltpetre from India remains prohibited.

LONDON WOOL-SALES.

The following are the High Commissioner's cabled reports regarding the London wool-sales, received since those published in the February issue of the *Journal*:—

SECOND SERIES.

29/2/16.—The wool-sales commenced with good competition for coarse crossbreds and medium crossbreds, although the high prices ruling are making buyers cautious and reluctant to bid freely. Prices are slightly lower than at the close of last series, but better bidding is anticipated during the next few days. For fine crossbreds and merinos the market is a shade weaker, with prices 1d. lower. 33,000 bales of New Zealand wool are catalogued.

17/3/16.—The wool-sales closed firm at the lower prices established, after having been 10 per cent. lower. Prices recovered slightly, and present quotations

for medium and coarser sorts are 1½d. to 2d. below the closing rates of last sales. Finest grades about maintain old prices. 8,000 bales have been taken for export to the Continent and Russia. America is not operating. Estimated values are as follows: Fine crossbreds, 1s. 8d. to 1s. 11d.; medium crossbreds, 1s. 6d. to 1s. 8d.; coarse crossbreds, 1s. 4d. to 1s. 6d.; superior merinos, 1s. 7d. to 1s. 9d.; medium merinos, 1s. 4d. to 1s. 6d.; inferior merinos, 1s. 1d. to 1s. 3d. Future prospects are good at these lower prices. 3,500 bales of New Zealand wool were held over.

THIRD SERIES.

11/4/16.—The wool-sales have commenced. There is great competition for all wools, but buyers are cautious on account of the high prices and uncertainty as to attitude with regard to limitation of future contracts. Values average ½d. lower than the closing rates of last sales. 56,000 bales of New Zealand wool are catalogued.

15/4/16.—Market firm, with hardening tendency; merinos ½d. dearer, crossbreds unchanged.

THE HOP-MARKET.

REPORTING on the hop-market in London, under date 8th February, the High Commissioner states:—

"Owing to recent licensing legislation (which considerably restricted the hours for the sale of alcoholic liquors) the market for hops has been rather dull. During the past fortnight, however, the demand has considerably improved, and holders of hops are now firm in their demands for any lots they may have for sale. I do not anticipate, however, that prices will advance to any extent."

The High Commissioner's cabled market report, dated 15th April, gives the following information regarding hops: "The market is quiet but firm. Stock is small—English per cwt., 130s. to 150s.; Californian, 100s. to 120s."

THE WORLD'S CEREALS.

IN a note, dated the 10th January, 1916, on the World's Yield of Food Crops, Sir J. Wilson, British delegate to the International Institute of Agriculture, dealing with cereals—wheat, rye, barley, oats, and maize—states as follows:—

"These grains are not all of the same nutritive value, but they are all used to some extent for human food, and can be substituted one for the other in case of need. Putting these five grains together, countries which on the average produce more than four-fifths of the reported crops have officially estimated their yield for the harvest year now ending as equivalent to 119 per cent. of their last year's yield, and to 114 per cent. of their average yield for the previous five years. Even after making allowance for decreased production and waste of grain in the countries at present devastated by war, there seems reason to believe that the supply of the cereal food-grains in the world as a whole is at present considerably larger than it was at the same period of the year on the average of the last five years, while the effective demand for these grains for the world as a whole is likely to be below the average of the years before the war.

NEW ZEALAND EXHIBIT AT NEW YORK.

UNDER the management of an organization styled the Panama Pacific Medal winners' Association, shows were held at Chicago and New York after the clos of the Exhibit on at San Francisco. The exhibits at these shows were confine to goods, &c., which had been awarded medals at the Panama Pacific Exhibitio

A small but attractive exhibit of New Zealand products was made at the New York show by the New Zealand Commissioner, the display running from 12th to 22nd February. The accompanying photograph shows the exhibit in the Grand Central Palace. In view of a prospective trade development with the eastern United States after the war, it is considered that a useful advertisement has been secured for the Dominion.

NEW ZEALAND EXHIBIT AT NEW YORK.

The exhibits on side not shown in photograph consisted chiefly of wool and preserved-meat samples.

COMPILED FROM MANIFESTS OF VESSELS SAILED DURING RESPECTIVE MONTHS OF CURRENT AND PRECEDING SEASONS.

Month.		Mutton, Carcases.	Lamb, Carcases.	Beef, Quarters.	Pork, Carcases.	Butter, Boxes.	Cheese, Crates.	Wool, Bales.	Wheat, Sacks.	Oats, Sacks.	Rabbits, Crates.	Hemp, Bales.	Tow, Bales.	Kauri-gum, Pkgs.
January,	1916	166,700	295,170	41,726	179	108,593	101,917	92,849	..	..	..	7,438	1,666	1,218
,,	*1915*	*137,816*	*296,439*	*45,622*	*339*	*138,081*	*85,123*	*87,393*	..	..	*2,860*	*683*	..	*1,209*
February,	1916	170,973	266,414	29,056	23	96,096	84,740	96,016	..	..	..	8,161	1,804	1,900
,,	*1915*	*433,585*	*517,581*	*77,421*	*311*	*119,371*	*96,090*	*159,347*	..	..	..	*13,111*	*6,619*	*2,763*
March,	1916	327,977	363,269	83,725	..	59,671	62,082	49,750	..	..	474	2,666	637	1,247
,,	*1915*	*80,439*	*203,480*	*30,176*	..	*55,280*	*51,811*	*49,809*	..	..	..	*8,410*	*185*	*274*
April,	1915	286,155	328,779	45,340	..	6,703	38,561	41,371	..	..	1,011	9,328	1,474	3,461
,,	*1914*	*234,765*	*366,786*	*22,185*	..	*7,822*	*63,796*	*58,488*	..	*2,901*	..	*1,247*	*888*	*5,909*
May,	1915	257,953	433,831	34,780	655	148	17,065	21,615	..	..	2,923	4,968	808	2,636
,,	*1914*	*336,632*	*638,397*	*39,315*	*54*	*837*	*37,776*	*43,364*	*3,623*	*11,062*	..	*8,355*	*2,112*	*9,316*
June,	1915	99,080	154,785	19,316	932	..	26,869	11,946	..	..	9,800	5,027	1,320	1,229
,,	*1914*	*261,877*	*634,981*	*36,400*	..	*1,153*	*19,247*	*18,774*	..	*28,141*	*1,000*	*7,924*	*4,258*	*7,881*
July,	1915	243,420	340,476	21,231	154	..	21,520	16,039	..	..	5,968	5,068	1,639	4,184
,,	*1914*	*225,411*	*239,143*	*38,170*	..	*1,355*	*2,003*	*15,868*	..	*1,425*	*1,000*	*5,810*	*2,584*	*8,053*
August,	1915	510,418	570,381	51,750	35	..	18,287	19,416	..	..	31,790	7,138	1,466	4,848
,,	*1914*	*84,251*	*63,111*	*19,094*	*516*	*1,979*	*50*	*4,845*	*600*	*38,220*	*10,403*	*367*	*245*	*3,705*
September,	1915	299,715	330,643	59,487	..	26,416	2,595	5,360	..	..	7,750	2,022	3,091	595
,,	*1914*	*53,386*	*49,200*	*2,353*	..	*15,885*	..	*3,337*	..	*5,896*	*7,288*	*1,143*	*57*	..
October,	1915	367,198	417,794	87,104	..	111,468	49,160	7,272	..	..	56,636	5,650	1,645	1,230
,,	*1914*	*291,432*	*128,016*	*49,104*	..	*81,842*	*30,487*	*8,938*	..	*68,660*	*38,121*	*2,042*	*1,650*	*1,683*
November,	1915	93,777	92,601	21,609	..	81,102	47,243	18,715	..	..	13,538	5,064	1,789	868
,,	*1914*	*136,346*	*27,577*	*48,302*	*27*	*98,729*	*70,048*	*37,604*	*15*	*24,289*	*35,783*	*885*	*110*	*1,377*
December,	1915	91,124	59,231	36,467	..	214,967	81,939	33,527	..	..	3,052	6,016	1,940	5,555
	1914	*102,052*	*140,835*	*44,876*	..	*172,990*	*80,144*	*86,317*	..	..	*9,306*	*1,136*	*116*	*2,157*

LONDON MARKET VALUES.

COMPARATIVE STATEMENT COMPILED FROM THE HIGH COMMISSIONER'S CABLES FOR THE PAST THREE MONTHS.

London Date.	Wool. Bradford Quotations for Tops. 36's.	40's.	44's.	50's.	56's.	60's.	Mutton. Canterbury.	Mutton. North Island.	Lamb. Canterbury.	Lamb. Other than Canterbury.	Beef. New Zealand Hinds.	Beef. New Zealand Fores.	Butter. Danish.	Butter. New Zealand.	Cheese. New Zealand White.	Cheese. New Zealand Coloured.	Cheese. Canadian.	H mp (Spot). New Zealand Good-fair.	H mp (Spot). New Zealand Fair.	H mp (Spot). Manila Fair (New Grade).	Hemp (Forward Shipment). New Zealand Good-fair.	Hemp (Forward Shipment). New Zealand Fair.	Hemp (Forward Shipment). Manila Fair (New Grade).	Wheat. N.Z. Short-berried.	Wheat. N.Z. Long-berried.	Oats. N.Z. Sparrowbills.	Oats. N.Z. Danish.
1916.							d.	d.	d.	d.	d.	d.															
Jan. 8	..	..	..	..	..	..	7⅜	..	7¾	..	6¼	5¼	156/0	148/0	94/0	93/0	97/0	..	..	..	40/10/0	38/10/0	50/0/0	..	..	..	..
" 15	..	..	..	..	..	..	7½	..	7¾	7¾	..	..	158/0	152/0	98/0	98/0	99/0	41/10/0	40/0/0	51/0/0	41/0/0	39/0/0	50/0/0	..	..	..	..
" 22	..	..	..	..	..	..	7⅝	..	7⅞	7⅞	..	..	158/0	146/0	98/0	98/0	99/0	45/0/0	43/0/0	55/0/0	44/0/0	42/0/0	..	..	..	..	..
" 29	..	..	..	..	..	..	7⅝	..	7⅞	7⅞	..	..	157/0	146/0	98/0	98/0	99/0	47/10/0	46/0/0	55/0/0	46/10/0	45/0/0	54/0/0	..	..	..	..
Feb. 5	..	..	..	..	..	..	7⅝	..	7⅞	7⅞	6½	5½	157/0	151/0	98/0	98/0	99/0	47/10/0	45/10/0	55/0/0	47/0/0	45/0/0	54/0/0	..	..	..	..
" 12	..	..	..	..	..	..	7⅝	7½	8	8	6½	5½	160/0	153/0	..	..	97/0	..	..	..	..	..	55/10/0	..	..	..	..
" 19	2/3½	2/5	2/6	2/11	3/4	3/8	7⅝	..	8⅛	*9	6½	5½	166/0	155/0	95/0	96/0	99/0	47/10/0	45/10/0	56/0/0	47/0/0	45/0/0	..	..	..	..	..
" 26	2/3	2/4½	2/5½	3/10½	2/3½	3/7½	7⅝	..	8¼	*9	6½	5¾	174/0	159/0	95/0	96/0	99/0	49/10/0	45/10/0	..	46/10/0	44/10/0	55/10/0	..	..	..	..
March 4	..	..	..	..	..	..	7⅝	7⅝	8¼	*8¾	..	..	179/0	162/0	97/0	98/0	99/0	..	..	..	46/15/0	45/5/0	56/10/0	..	..	..	..
" 11	..	..	..	..	..	..	7⅝	7⅝	8¼	*8¾	..	..	182/0	163/0	99/0	99/0	103/0	47/0/0	45/10/0	57/0/0	46/10/0	44/10/0	56/0/0	..	..	..	..
" 18	..	..	..	..	..	..	7⅝	7⅝	8¼	*8¾	6½	5½	181/0	163/0	102/0	103/0	105/0	..	46/0/0	56/10/0	46/5/0	44/5/0	55/0/0	..	..	..	..
" 25	..	..	..	..	..	..	7⅞	7⅞	*9	*9	..	..	178/0	163/0	102/0	103/0	106/0	..	..	55/0/0	..	45/5/0	..	..	..	..	..
April 1	..	..	..	..	..	..	7⅞	7⅞	*9	*9	..	..	172/0	163/0	103/0	103/0	107/0	47/10/0	45/10/0	..	46/10/0	44/10/0	..	..	..	..	..
" 8	..	..	..	..	..	..	7⅞	7⅞	8¾	8¾	7	6	174/0	163/0	103/6	103/6	107/0	49/0/0	47/0/0	54/0/0	47/10/0	45/10/0	53/0/0	..	..	..	..

* New season's.

STOCK EXPORTED.

THE following table shows the number and descriptions of stock exported from the Dominion during the month of March, 1916:—

Port of Shipment.	Horses.		Sheep.			Cattle.		Pigs.	Dogs.
	To Australia.	To Eastern Pacific.	To Australia.	To Eastern Pacific.	To San Francisco.	To Australia.	To Eastern Pacific.	To Eastern Pacific.	To Eastern Pacific.
Auckland ..	20	11	..	268	..	..	10	21	..
Gisborne ..	..	..	..	..	..	..	..	..	..
Napier ..	..	..	..	..	..	..	..	..	..
Wellington ..	11	..	26	..	..	..	..	..	..
Lyttelton ..	2	1	623	..	95	..	..	..	..
Dunedin ..	12	..	1	..	..	..	..	..	..
Bluff	2	..	100	..	..	..	..	..	..
Totals ..	47	12	750	268	95	..	10	21	..

The following are particulars of horses shipped: 12 draught stallions and 2 mares; 4 light-draught mares; 6 medium-draught mares and 1 gelding, 1 light mare; 5 thoroughbred colts, 5 fillies, and 1 mare; 1 gelding hack; 20 mixed horses (Worth's *circus troupe*).

Auckland also exported 1 crate poultry.

STOCK IN QUARANTINE.

THE following stock was received into quarantine during the month of March, 1916:—

No.	Description.	Sex.	Port of Origin.	Owner or Agent.	Address.
			MOTUIHI ISLAND (AUCKLAND).		
20	Romney ewes ..	Female	London ..	E. Mitchelson and Co.	Auckland.
			SOMES ISLAND (WELLINGTON).		
1	Pomeranian dog	Female	London ..	S. Johnson ..	20 Waldegrave Street, Palmerston N.
			QUAIL ISLAND (LYTTELTON).		
			Nil.		

HEMP AND TOW GRADING RETURNS.

MARCH.

Hemp.—The total number of bales graded was 16,622, as compared with 9,373 for the corresponding month of last year, an increase of 7,249 bales. For the twelve months ending 31st March, 1916, the number of bales graded was 137,882, as compared with 82,987 for the previous twelve months, an increase of 54,895 bales.

Tow.—During the month 4,598 bales were dealt with, as compared with 2,192 for the corresponding month of last year, an increase of 2,406 bales. For the twelve months ending 31st March, 1916, the number of bales graded was 38,898, as compared with 23,374 for the previous twelve months, an increase of 15,524 bales.

Stripper-slips.—The number of bales graded was 831, as compared with 276 for the corresponding month of last year, an increase of 555 bales. For the twelve months ending 31st March, 1916, the number of bales graded was 5,885, as compared with 1,482 for the previous twelve months, an increase of 4,403 bales.

HEMP, TOW, AND STRIPPER-SLIPS GRADED THROUGHOUT THE DOMINION DURING THE MONTH OF MARCH, 1916.

Hemp.

Port.	Superior.	Fine.	Good-fair.	Fair.		Common.	Rejected.	Condemned.	Total.
				High Point.	Low Point.				
	Bales.	Bales.	Bales.	Bales.	Bales	Bales.	Bales.	Bales.	Bales.
Auckland ..	..	10	326	1,062	1,022	426	38	..	2,884
Napier ..	..	..	67	9	..	..	..	..	76
Wairoa ..	..	..	..	..	..	..	..	..	..
Foxton ..	..	..	2,605	1,548	1,368	126	65	..	5,712
Wellington ..	..	..	1,449	3,168	1,203	79	2	..	5,901
Picton ..	..	62	10	..	..	..	..	..	72
Blenheim ..	..	..	147	3	11	..	..	..	161
Lyttelton ..	..	..	..	..	..	..	..	..	..
Dunedin ..	..	..	131	106	15	..	..	..	252
Bluff	..	..	248	1,090	208	18	..	..	1,564
Totals ..	..	72	4,983	6,986	3,827	649	105	..	16,622
Percentages of totals	..	0·43	29·98	42·03	23·03	3·90	0·63	..	..

Tow.

Port.	First Grade.	Second Grade.	Third Grade.	Condemned.	Total.
	Bales.	Bales.	Bales.	Bales.	Bales.
Auckland ..	..	364	580	106	1,050
Napier	..	13	..	..	13
Foxton	489	856	201	..	1,276
Wellington ..	324	647	420	19	1,410
Picton	..	34	..	..	34
Blenheim ..	86	10	..	..	96
Lyttelton ..	..	..	..	..	..
Dunedin ..	..	101	..	1	102
Bluff	..	227	362	28	617
Totals ..	899	1,982	1,563	154	4,598

Stripper-slips.—Auckland: First grade, 5; second grade, 9; condemned, 3. Napier: Second grade, 9. Foxton: Second grade, 419. Wellington: First grade, 149; second grade, 131; condemned, 3. Blenheim: Second grade, 21. Dunedin: Second grade, 45. Bluff: Second grade, 35; condemned, 2.

The

Journal of Agriculture.

WELLINGTON, NEW ZEALAND.

20TH MAY, 1916.

LIMING.

PRINCIPLES AND PRACTICE.

A. McTAGGART, M.S.A., Agriculturist.

THE term "lime," though it usually refers to the burnt, oxide, quick, or caustic form of lime, through long usage of this form for building and agricultural purposes, in reality embraces various salts of the metal calcium. In nature calcium is found principally in two forms—as calcium carbonate (limestone) and as calcium sulphate (gypsum). By far the greater portion of this metal is found in the carbonate form, and this is of organic origin, being for the most part the remains of early minute marine life known as foraminifera.

Lime has been used for agricultural purposes since the dawn of agricultural history, and it is interesting to note here that in those early times and onwards it was the calcium carbonate, in

the form of chalk or marl, that was used for soil-improvement. That this great soil-improver is needed in most parts of New Zealand, whose soils for the most part are well supplied with acidity and, in many instances, are in an unsatisfactory physical condition, is now generally recognized by our farmers. But what really is required by the farming community generally is a clearer understanding of the chemistry of lime, of the properties and uses of lime in agricultural practice, of the forms in which lime should be applied to suit special soil-conditions, of the distribution of lime in its various forms, and of the economics of liming with special reference to purchase, haulage, and forms and quantities to apply under varying conditions. This article is an endeavour to assist towards a better apprehension of these factors.

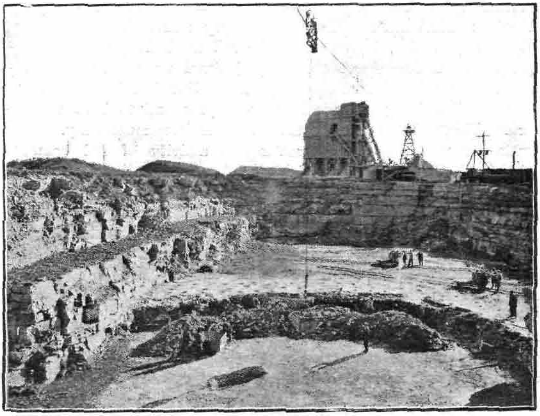
FUNCTIONS OF LIME.

There are two principal effects produced by applying lime to soils. One of these is to furnish a base for neutralizing the acids that may exist in the soil or that may form as the result of such necessary processes as nitrification. Through the decomposition of organic matter (vegetable and animal) by bacteria, available or soluble nitrates are finally formed, but acids of various kinds (principally humic acid) are produced. These latter require to be neutralized by a base to keep the soil fully productive. As a result of this continuous breaking-down process yielding free acids the bases in the soil (principally lime) are being gradually used up for neutralizing the acidity thus produced. Strictly, acidity does not accumulate in the soil, but by finally neutralizing all the lime present it renders the soil sour. Such a soil requires lime to render it fertile, or, in other words, to supply a base for the neutralizing of acids continuously being formed by bacterial activity and for the formation of nitrates by the nitrifying bacteria. The acidity arising from the application of acid fertilizers such as superphosphate, sulphate of ammonia, &c., and from the toxic substances believed to be given off by plants, particularly fern and manuka, in like manner calls for a base to neutralize it.

In addition to the above-mentioned function of a base is that of supplying a mineral in small quantity for the ready formation from ammonia and nitric acid of the nitrate itself, in which soluble form alone a plant can take up its food. From this we glean that a predominance of evolved acidity and an almost total absence of lime are decidedly detrimental to the formation of the desirable nitrates by bacteria. In short, the nitrifying bacteria are for the most part inactive in a predominatingly acid (sour)

soil. To correct or neutralize that acidity is therefore important. Indeed, the chief reason, and usually the only justifiable reason, for applying lime to soils is to correct or neutralize soil-acidity.

The other principal effect of applying lime to soils is that of promoting a more active decomposition or destruction of the soil itself, especially of its organic matter or humus content. The reserves of raw material, organic and mineral, are in part (varying with the form and quantity of lime applied) released and converted by chemical and bacteriological action into available or soluble plant-food. The decay of vegetable and animal matter and its



A MODERN LIMESTONE-GRINDING PLANT.

conversion into a soluble form are accelerated. Potash and to some extent slowly soluble natural soil phosphates are released and converted into available or soluble forms. It is largely due to the previously unavailable potash, held in close association with the silicates, in clay soils, being released or made available that we find lime giving specially good results on such soils. The need for potash manuring will for a time be eliminated by liming soils, but there will come a time, especially on the lighter soils, when potash manuring in some form will have to be practised. On the heavier soils, which are as a rule abundantly supplied with humus, the

organic matter decomposes slowly, and lime is of special value for accelerating this decomposition. On the other hand, where a soil is not very well supplied with humus, as indicated by the absence of or deficiency in good dark colour and by "floury" texture, the burnt lime in particular, if applied in anything but small quantities, results in injury to the soil through causing a rapid decomposition of what little humus is present. Burnt lime, in anything but small applications, rapidly exhausts light lands, due principally to the loss from the humus into the air of nitrogen in ammonia form and into the subsoil by leaching of nitrates.

Other effects of lime, of lesser importance than those above enumerated but more or less closely associated therewith, are the following: Lime mellows heavy and clayey soils by flocculating the colloids of the clay, thus making the soil more friable and permeable. Both drainage and capillarity (natural upward flow of soil-water), also the aeration of the soil, are therefore improved, and the soil is less likely to become over-compact and to bake and to crack. The maintenance of tilth is therefore more easy. The aeration of the soil also promotes the activity of soil bacteria which prepare the raw materials for use by the young growing plant. On the other hand, lime compacts loose open soils. The warming of the soil, by lime improving its aeration, also has a decided bacteriological effect. Phosphatic fertilizers are often rendered more effective. This seems to be especially true of the less soluble fertilizers, such as finely ground rock phosphates. Indeed, all fertilizers would appear to be rendered more effective by the use of lime applied well beforehand, and especially is this true of the acid fertilizers. A moderate application of lime, especially if used in connection with green-manuring or an application of farmyard manure, will increase the capacity of the lighter soils to retain moisture. Then there is the action of lime in the conserving of free phosphoric acid, which exists naturally in the soil or as the product of phosphatic manuring. The lime combines with this free phosphoric acid, converting it into a slowly soluble phosphate and thereby holding it for subsequent crops.

The presence of lime in the soil is highly unfavourable to the parasitic organisms which are the cause of certain diseases. Most important among such diseases is club-root of turnips, swedes, cabbages, and other cruciferous crops. Heavy dressings of burnt lime will, as a rule, destroy the acid-loving organism responsible for this disease. If the soil is badly infested, lime may not prove a complete prevention, but the free use of burnt lime without doubt greatly decreases the tendency for this and other fungus diseases to attack farm crops.

The nutritive value and palatability of grasses are improved to some extent, also the health of stock, as the result of applications of lime to land. In general, a nutritious herbage results, and the increased supply of flesh- and bone-forming materials promotes thrifty, healthy animals.

Finally, there is the important function of lime in greatly stimulating the growth of legumes, particularly lucerne and clovers. These most valuable fodder plants, being nitrogen-gatherers, enrich the soil in that valuable constituent, and to a greater degree when they are well supplied with lime. (There is no plant that requires lime to a greater extent than lucerne.) Thus, lime is indirectly a nitrogen-gatherer, the soil-air being the source of supply and the bacteria in the nodules on the roots of legumes the direct agents in this gathering process. Lime also beneficially influences the few forms of non-symbiotic bacteria in the soil, or those that draw nitrogen from the air without the assistance of leguminous plants.

From the above-mentioned facts it will be seen that lime is indirect in its action. In itself it is not a manure, for it is assimilated by plants, except by lucerne and red clover, in only very small quantities. Its great function is not as a manure, but as a releaser or preparing agent of soluble plant-food constituents, and its action in connection with those processes is threefold—physical, chemical, and biological or bacteriological.

INDICATIONS OF THE NEED FOR LIME.

The presence in quantity of sorrel and of other acid-loving plants such as spurrey (yarr), moss, horsetails, blackberry, foxglove, bracken, manuka, and the inferior bent grasses (principally red-top and fiorin) are, as a rule, indicative of a sour soil and that applications of lime will be decidedly beneficial. Sorrel has, however, been known to thrive in a soil which has been heavily limed, due to other deficiencies in the soil preventing the grasses and clovers thriving sufficiently to crowd out the sorrel; but as a rule the liberal use of lime on the average soil will stimulate the grasses and clovers to such an extent as to crowd out or keep in check the sorrel. The presence of acidity encourages sorrel, while a liberal application of lime stimulates the valuable grasses and clovers to a much greater extent, the result being the ascendency of the latter.

Where clovers and the better grasses, such as timothy and rye grasses, but especially clovers, will not thrive, lime as a rule is required. The clovers either become sickly-yellow or disappear.

On cold clay soils we frequently find the better grasses and clovers giving place to the inferior bent grasses, such as fiorin and red-top. As already indicated, these latter grasses like sour soils, and lime is required to encourage the superior vegetation. Foot-hill lands and lands at the base of hills are frequently sour, the characteristic vegetation being the bent grasses. Here liming is badly required, but drainage has frequently to be attended to first. There are in New Zealand thousands of acres of sour soils, for the most part clays or clay loams, of this class that specially require lime.

When a soil is sour it will turn blue litmus paper placed in contact with it red. To carry out the test make a small quantity of soil into a thin mud with pure water, and after its has stood for a short time place a slip of blue litmus paper on it and cover with the mud. After about ten minutes remove the paper, washing it, if necessary, in pure water to show the colour. If the paper has turned red the soil is sour and needs an application of lime to sweeten it. The litmus-paper test can also be made by inserting a slip of the blue paper into an incision made in the soil (stripped of its surface vegetation) with a knife and by pressing the soil firmly on either side of the paper. Practically all chemists keep litmus, which can be purchased very cheaply.

From the chemical standpoint—according to Dr. A. D. Hall—any soil that contains less than 1 per cent. of carbonate of lime can be improved by liming, and any soil containing less than 0·2 per cent. of lime carbonate cannot make proper use of fertilizers applied thereto.

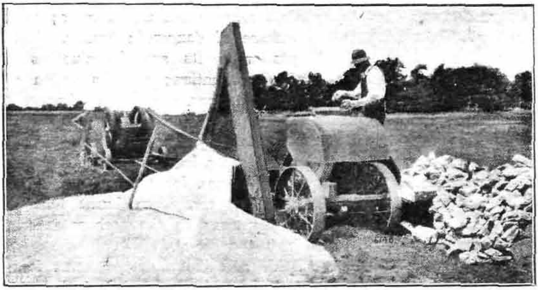
Soils that are refractory or stiff and hard to work, as, for instance, most clay soils; drained swamp soils; light open soils; soils that have been cleared of fern or manuka; soils affected with club-root of turnips; soils which do not grow clovers well; soils well supplied with the acid-loving plants enumerated above; and soils upon which superphosphate has been used for years—these are in greatest need of lime.

FORMS OF LIME TO USE.

The forms of lime commonly used in agricultural practice are burnt lime and carbonate of lime (ground limestone). The former should only be used in quantity (heavy or moderately heavy dressings) on soils well supplied with humus as indicated by good dark colour to a fair depth. It has the tendency to burn out (oxidize) the humus, and for this reason is inclined to be exhaustive, particularly on light lands not very well supplied with organic

matter. The old adage, "Lime and lime without manure makes both farm and farmer poor," refers to this exhausting effect of burnt lime, and not to the mild and inexhaustive carbonate of lime. Of course, burnt lime in quantity could be used even on light lands if provision were made for the keeping-up of the humus-supply by periodic applications of farmyard manure or by systematic green-manuring. But in this country we produce little farmyard manure, and we have no guarantee that farmers as a whole will seriously adopt systematic green-manuring.

From the point of view of haulage, however, burnt lime is the more economical form to use, provided too heavy dressings are not applied, for 56 lb. of the burnt lime is equivalent to 100 lb.



AN AMERICAN PORTABLE LIMESTONE-GRINDER.

of the carbonate form. In other words, if a farmer purchases 100 tons of carbonate of lime (ground limestone) he will have in reality only 56 tons of lime—that is, lime in the burnt or oxide form. The balance (44 tons) will consist for the most part of a gas known as carbon dioxide; and there is usually plenty of this gas in the soil-air, for it is given off by the roots of plants. The haulage of this extra 44 tons a distance from the railway is therefore to some extent an economic loss. This points to the use of burnt lime on soils situated some distance beyond the 100-mile railway limit from the source of supply, or located back from the railway a distance that has to be considered in the haulage of materials. On the lighter of such soils so situated burnt lime should be used only in comparatively small quantities and at a

little more frequent intervals than where moderately large dressings are applied to strong soils—soils well supplied with humus.

For soils within striking distance from the railway, and not situated more than a few miles beyond the 100-mile limit of free railage, the ground limestone could more economically be used on all soils, but particularly on the lighter soils, provided the price is not more than one-half to two-thirds of that charged for burnt lime. In other words, where 20s. per ton is charged for burnt lime not more than 11s. 3d. per ton should be charged for carbonate of lime. But other factors render carbonate of lime worthy of a higher value than that just calculated by comparing the two forms on the basis of calcium-content. These factors are the inexhaustive nature of carbonate of lime and its consequent suitability for application in large quantities to all types of soil; its agreeable condition to handle for both man and horse as compared with burnt lime; the absence of danger in haulage or in storage when the material gets wet; its special value as a base for nitrate (soluble plant-food) formation; and its action as a carrier of carbon dioxide, whose component parts (carbon and oxygen) are essential plant-foods, and in this form add to what are already enclosed in the soil. Relatively, therefore, anything up to about 15s. per ton may be considered a legitimate price for first-grade carbonate of lime compared with 20s. for the burnt, caustic, oxide, or quick form of lime. Moreover, when burnt lime is applied to the land it ultimately returns to the carbonate form by taking up carbon dioxide from the soil-air.

If we were to trace the history of the use of the burnt form of lime, we would find that the early agriculturists found that the only practicable way in those early times to render the limestone available for application to the land was to burn the rock, from which form it fell away to a powder (slaked) upon applying water to it. But to-day we are living in an age of machinery, and powerful machines are manufactured for grinding rock to a powder, thus making limestone available by means other than burning for use on farm lands.

Soil chemistry and field experiment have revealed to us the value of powdered limestone for agricultural purposes and of its equal or, indeed, superior merit as compared with burnt lime for soils requiring lime. In support of this assertion one cannot do better than quote directly from the writings of Dr. C. G. Hopkins, of Illinois University, one of the foremost authorities in America on soils. Dr. Hopkins states,—

"The most extended investigation ever conducted relating to the use of burned lime and ground limestome in comparative tests is

reported by the Pennsylvania Experiment Station (Report, 1902). Four plots were treated with burned lime (slaked before being spread) at the rate of 2 tons per acre once in four years. Four other plots were treated with ground limestone at the rate of 2 tons per acre every two years. A four-year rotation was practised, consisting of corn (maize), oats, wheat, and hay (mixed timothy and clover) seeded on the wheat land in the spring. By having four sets of plots, each crop was grown every year. Seven products were obtained and weighed each year—namely, corn, corn-stover, oats, oat-straw, wheat, wheat-straw, and hay. After twenty years' results had been obtained (1882 to 1901), the Pennsylvania Station reports data showing that with every product a greater total yield had been obtained from the plots treated with limestone than from those treated with caustic lime. Furthermore, with every product whose total yield for the last eight years of the experiment was greater than the total yield of the first eight years the limestone produced a greater increase than the caustic lime; and with every product whose total yield for the last eight years was less than the total yield of the first eight years the decrease was less where limestone was used than where caustic lime was applied (oat-straw alone excepted). This is significant, in that it demonstrates the tendency of caustic lime with continued use to exhaust or destroy the fertility of the soil. In discussing these investigations, Dr. Frear, of the Pennsylvania Station, says: 'In each case the yields with the carbonate of lime showed superiority under the conditions of this experiment over those following an equivalent application of caustic lime.'

"After these experiments had been in progress for sixteen years the soil of each of the four plots in each test was sampled for analysis. The average nitrogen-content for the four plots receiving ground limestone was found to be 2,979 lb. per acre to a depth of 9 in., while only 2,604 lb. were found in the soil treated with caustic lime. This difference of 375 lb. of nitrogen is equal to the nitrogen contained in 37½ tons of farm manure. In other words, the data indicate that the effect of caustic lime as compared with ground limestone was equivalent to the destruction of 37½ tons of farm manure in sixteen years, or more than 2 tons a year to the acre; or, if we count the soil nitrogen worth 15 cents (7½d.) a pound (a fair market price), there is a liberation of more than $7·00 (28s.) worth of nitrogen for every ton of burned lime used during the sixteen years.

"The Maryland Experiment Station has recently reported experiments with different kinds of lime, covering eleven years, with a rotation of corn, wheat, hay (timothy and clover), 1,400 lb. of calcium oxide (burned lime) and equivalent amounts of calcium carbonate (ground oyster-shells and shell marl) having been applied per acre at the beginning. Four crops of corn, three of wheat, and four crops of hay were harvested during the eleven years. In commenting on the results, Director Patterson, of the Maryland Experiment Station, says, 'It will be noted that the carbonate of lime gave decidedly better results than the caustic lime.'

"Porter and Grant, in a recent Farmers' Bulletin issued by the agricultural department of the County Council of Lancaster, England,

report experiments on manured and unmanured meadow lands, showing that ground limestone is more profitable as an application to grass lands than burned lime, and that it can be economically used on grass lands which are in need of lime.

"No trustworthy investigations support the use of burned lime in preference to ground limestone; although we have ample information showing that on many soils a moderate use of burned lime in connection with a liberal use of farm manure and green manures yields profitable returns, which would, no doubt, be still more profitable if the burned lime were replaced with ground limestone."

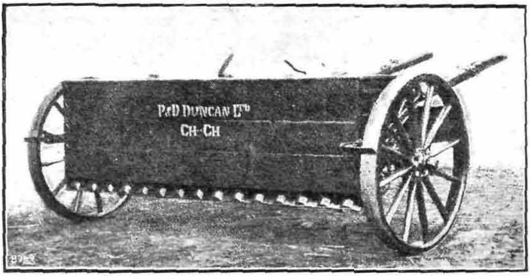
Such indisputable evidence shows clearly the superiority of powdered limestone over caustic lime in actual agricultural practice; but the decision of the farmer as to which form he shall purchase must be determined mainly by the forms purchasable, by the market price of each form, and by the location of his land with respect to the source of lime-supply and to distance from the railway. Where these considerations are negligible the evidence is in favour of the use on all soils of the carbonate of lime.

As to the relative availability (solubleness) of burnt lime and carbonate of lime the former is quicker in its action undoubtedly, but the carbonate, if in a finely divided condition, proceeds to do what is required of it (chiefly to neutralize soil-acidity) without undue delay. In other words, when finely ground it is for all practical purposes comparable with burnt lime in readiness of action; and particularly is this so in a damp climate where as a rule soil-acidity is most marked. Acidity of the soil in a sense is a blessing in disguise in that it renders more quickly available or soluble the ground limestone than would obtain under drier and less acid soil-conditions. As might be expected, the burnt lime would produce a greater increase in the crops for the first year or two than could be produced by the ground limestone, more especially where the minerals phosphorus and potassium are not applied, the reason being that ground limestone produces only the milder action — chiefly that of correcting the acidity of the soil and thus encouraging the multiplication and activity of the nitrogen-gathering and nitrifying bacteria. The burnt lime not only produces this same effect, but it also acts as a powerful soil-stimulant, or soil-destroyer, attacking and destroying the organic matter, and thus liberating plant-food from the soil, usually resulting in more or less waste of valuable nitrogen and humus. This latter result takes place particularly when heavy or moderately heavy applications of burnt lime are applied to the land, particularly to light land.

Carbonate of lime in finely divided form has been found occurring in a natural state in very large quantities in various

parts of Canterbury, Marlborough, and southern Nelson. It is also known to exist at Lake Hayes in Otago, and occurs in parts of the east coast section of the North Island. Such deposits are of very great agricultural value, and the farming community generally should appreciate that fact sufficiently so that adequate steps might be taken by the farmers themselves to make these deposits available at a reasonable cost for application to widely scattered sour soils.

To test the naturally ground carbonate of lime from the Waikari deposits, and generally to provide further evidence of the value of this form of lime (under New Zealand soil-conditions), an extensive series of demonstration experiments were initiated last spring throughout the Canterbury Province by the Fields

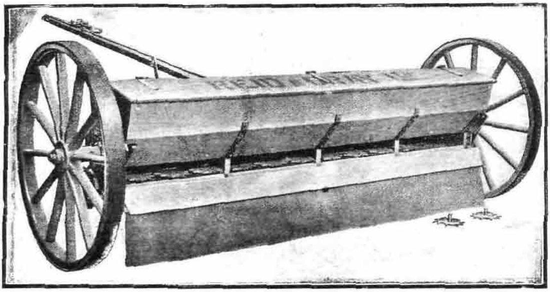


A GOOD TYPE OF "STAR-FEED" DISTRIBUTOR OF LARGE CAPACITY, FOR FINE LIME.

Division of the Department. Differing quantities of burnt lime and of carbonate of lime were sown on plots to be manured and unmanured alternately. The crops sown were either turnips to be followed by grass sown in 1916, or rape with grass sown at the same time. The effects of the various forms and quantities of lime are to be followed in the grass crop from year to year for the next few years. It is expected that the burnt lime will give the best results in the early stages of the experiments, for reasons mentioned above, but as time goes on the carbonate of lime will be expected to present the best showing. The past season has been dry in Canterbury, consequently no signs of results can be expected at the close of this autumn. Next spring the first results may be looked for.

Field experiments have already demonstrated near Auckland and at Marton Junction the value of ground limestone, especially when used in large quantities with small applications of fertilizers. At Marton Junction remarkable results were obtained with carbonate of lime applied at the rate of 4 tons per acre, together with a quantity of wood-ashes. (See *Journal*, October, 1915, p. 295.)

Limestone-crushing plants are in operation in various parts of New Zealand, and the work of pulverizing the rock is still being made the subject of experimentation to some extent. Nevertheless satisfactory machinery is obtainable for the production of this acceptable form of agricultural lime.



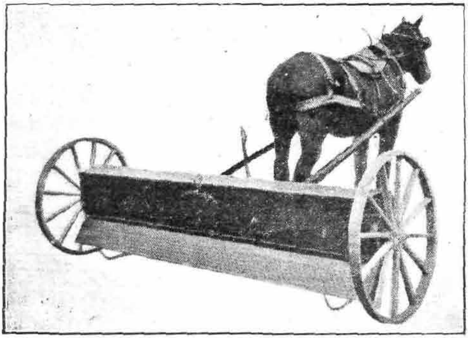
ANOTHER GOOD TYPE OF "STAR-FEED" MACHINE, FOR FINE LIME.

From the foregoing discussion it will be noted by farmers generally that there is a place for carbonate of lime as well as for burnt lime, the form to use being determined by the soil, location from the source of supply, and the market price of each form (assuming that both forms are obtainable in a particular region).

Where the application of lime as lime itself to land requiring it is beyond the ability of any farmer, due to distance from the source of supply, it can be gradually introduced into soil by the use of basic phosphates (principally basic slag and basic superphosphate) when periodically manuring for crop production. The process doubtless is slow, but "half a loaf is better than no bread."

THE APPLICATION OF LIME.

The rate at which lime should be applied to land depends upon the soil and to some extent upon the climate. An analysis of the soil is the only reliable guide as to whether or not a soil lacks in calcium carbonate, and, if this were carried out, the rate of application should as far as possible be accurately gauged from the result. There are certain natural evidences, enumerated above, of the urgent need for lime, but the approximate quantity to use on a particular soil can only be determined by analysis or by a system of carefully conducted experimental plots carried through several years.



THE "IDEAL" DISTRIBUTOR.—AN EFFECTIVE "FORCED STAR-FEED" MACHINE.

According to Dr. Hopkins, no fixed limits can be placed as yet upon the amounts of limestone to use as an initial application to acid soils. One ton to the acre, he says, is more than enough to destroy the acid commonly contained in ploughed soil, provided the limestone is sufficiently fine and thoroughly mixed with the soil; but, as a rule, it is less expensive to apply more limestone and then to allow the mixing to go on more slowly by the necessary processes of ploughing, disking, harrowing, &c., in the regular farm operations, keeping in mind also that the heavier the application the longer it will last. He further states that there is more or less acidity brought up from the acid subsoil, especially in time of drought, and that there should be sufficient limestone

in the surface to destroy this acidity as it rises. While a small amount of acidity in the surface may not be a serious injury when the rainfall is abundant, there is apparently in humid regions some rise of acidity from strongly acid subsoils in times of partial drought, corresponding somewhat to the "rise of alkali" in arid regions, where the water leaves the soil only by evaporation from the surface. From these remarks of a noted authority on soils one would judge that in a humid climate an application of limestone is just as necessary during a partial drought (to neutralize the risen acidity) as it is during periods of plenteous rainfall (to neutralize the acidity in, and being washed into, the subsoil). The moderately frequent applications of fair quantities of ground

A GOOD TYPE OF DISTRIBUTOR FOR FINE LIME, OR ROUGH LIME CONTAINING SEMI-HARD, SMALLISH LUMPS.

limestone in such climates seem necessary to keep this acidity neutralized in soil and subsoil.

Fortunately there is no danger of applying too much ground limestone to soils. At Rothamsted Experiment Station, in England, a century or more ago, certain fields were given heavy applications of chalk, dug out of pits excavated for the purpose, and the fact that some of these fields still contain 50 tons of calcium carbonate per acre in the ploughed soil and continue with fair treatment to produce good crops is proof sufficient that there is no danger of applying too much ground limestone. Dr. Hopkins advises an application of at least 2 tons of ground limestone per acre, where the addition of limestone is necessary,

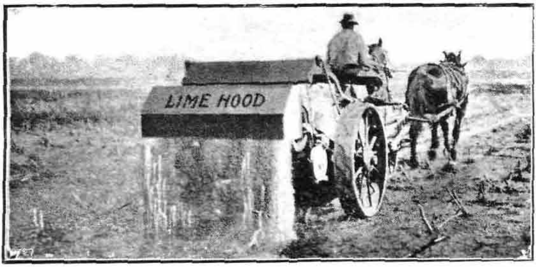
believing that less than this will not give satisfactory results in practice. Heavier applications, he states, will give greater profits per acre, but probably less profit per ton of limestone used. He further advises that if one must cultivate much land, and can use but little limestone, he should apply 2 tons per acre and plan to apply more in later years; but if one cultivates less land and wishes to improve it more rapidly he should apply 4 to 10 tons of ground limestone per acre, and it will give more marked results and will last much longer. As to investigations reported with regard to the losses of calcium carbonate from soils at Rothamsted (England) he states that practice based thereon would require an application of 2 tons per acre of ground limestone about every five or six years, in order to replace the regular losses.

Where burnt lime is advisable, under average soil-conditions at least 1 ton per acre every five or six years should be necessary on the basis of carbonate of lime experience of Rothamsted and Illinois. In the event of a soil being decidedly acid but well supplied with organic matter—as, for instance, a drained swamp soil—from 1 to 2 tons per acre every five or six years should be necessary. Where light lands requiring lime are situated some distance from the railway or source of supply, thus necessitating the use of the burnt form of lime, applications of 5 cwt. to 10 cwt. per acre every two or three years are decidedly preferable to 1 ton per acre every five or six years. The smaller applications of caustic lime on light soils are certainly more conservative of fertility than the heavier applications. Of course, the burnt (more concentrated) lime could be "air-slaked" by spreading out in an open shed for at least six months, and thereby rendered suitable for application in large quantities to light soils through reversion to the carbonate form.

Lime can be applied to land at any time during the year, but the time it is applied is usually governed by convenience. In districts where the roads are inferior the summer or autumn is the most suitable period. During this part of the year the limeworks are not so busy, and quick delivery of the order can usually be relied upon. Besides, by applying in the autumn the lime shows results in the following spring, and this applies especially to the carbonate form. When applied in the autumn or early winter lime is washed into the soil by the rains of winter, and the subsequent tillage operations complete the distribution of the material throughout the soil. Of course, lime, and especially the burnt lime, can be applied to land in early spring and show results during the following summer and autumn, particularly in a humid climate,

but more satisfactory results will be obtained if the lime is applied in the preceding autumn or early winter.

As *the subsoil requires lime just as much as the surface soil,* the most satisfactory way to apply the material would be to broadcast over the land, before ploughing (usually in the autumn), half of the quantity decided upon, harrow the ploughing once to permit of the traversing of the distributor, broadcast the additional lime on the ploughing and work in somewhat by a stroke of the tine harrow. When this land comes to be worked up for a subsequent crop the tillage operations will distribute well through the soil the lime that has not been washed in. Top-dressing grass land with lime — a commendable practice — is best done in the autumn or early winter, for the same reason as above mentioned.



FARMYARD-MANURE DISTRIBUTOR WITH LIMING-ATTACHMENT.

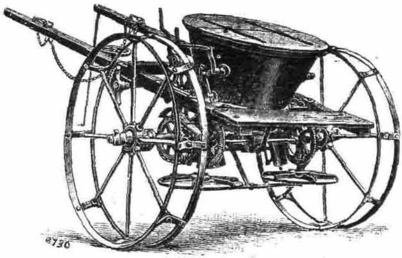
A useful machine for distributing farmyard manure, old stack-bottoms, or fine and lump lime.

The old method of applying lime is to cart out the shell lime (burnt-rock fragments—the purest form of burnt lime purchasable), place this in small heaps and cover with a layer of earth. After the heaps have remained for a few weeks and have slaked to a powder, the lime is spread in all directions with a shovel. This, of course, entails a lot of labour. The modern method is to make use of a lime-distributor, ground burnt lime or pulverized limestone being used according to the conditions already described.

There are various excellent distributors on the market. The "star-feed" design, an excellent type of machine for distributing lime in a finely divided condition, is represented by machines manufactured by P. and D. Duncan, and Cooper and Duncan, Christchurch; and by Reid and Gray, Dunedin. Other excellent

machines of this class for distributing fine lime are the "Ideal" (John Knight, Albany, Auckland, agent), and the distributors manufactured by Jack and Sons, Scotland (Booth, Macdonald, and Co., Christchurch, agents), and by the Massey-Harris Company. The distributors manufactured by the Armour, Johnston Company and by Messrs. Stonie, both of Invercargill, are also reported to be highly satisfactory.

Then there are machines on the New Zealand market that have been found more or less suitable for both fine lime and lime containing smallish semi-hard or hard lumps — the condition in which naturally ground limestone is sometimes found. These machines are the American Seeding Company's distributor (Mason,



THE WALLACE DISTRIBUTOR.

A good type of manure and lime (fine and lump) distributor for flat land and low hills.

Struthers, and Co., Christchurch, agents); the International Harvester Company's Hoosier No. 2 machine, and their Low-spread farmyard-manure distributor; and the Wallace lime and manure distributor (handles fine and lump lime well, but requires a calm atmosphere). Manson and Barr, Palmerston North, and the Canterbury Farmers' Co-operative Association, Christchurch, are the agents for the last-named distributor.

Practically all these machines have been used in the setting-up of experiments and all have been proved satisfactory for the form or forms of lime enumerated. It may also be mentioned that there is every reason to believe that before long there will be available a machine that will crush soft lump lime and distribute it in one operation.

Should a lime-distributor be beyond the reach of any farmer the material (finely divided) can be applied with an ordinary drill with coulters removed, but several drillings will require to be made to distribute the required quantity.

CONCLUSION.

It has been shown that lime judiciously used is an excellent material provided by natural processes for the improvement of agricultural lands and for rendering them productive or more fully so. Lime is a great instrument of production in the hands of a wise tiller of the soil; and in these days of national stress, when production from the soil should be promoted by all possible means, the intelligent free use of this soil amendment by our farmers is highly desirable. The soils of the humid sections of the country particularly should as far as possible be made the subject of this stronger-liming campaign.

CERTIFICATE - OF - RECORD BULLS.

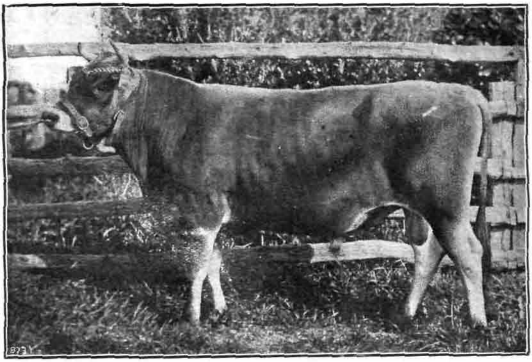
W. M. SINGLETON, Assistant Director, Dairy Division.

A LIST of certificated bulls was given in the writer's review of certificate-of-record testing operations published in the *Journal* for February last. Certain of these bulls and their C.O.R. daughters are commented on in the following notes:—

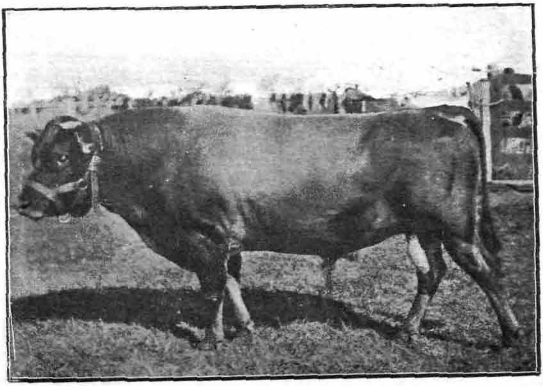
JERSEYS.

Golden Swan.—The bull Golden Swan, bred by Mr. J. H. Smith-Barry in Wiltshire, England, was imported by Mr. A. Moreland, of Papatoetoe. Four of Golden Swan's daughters have certificates of record, and a number of others are now on test. Owing to an exceedingly dry season those milking during 1914–15 did not do themselves justice, and the general average production of this bull's daughters is likely to be considerably raised as the result of the current season's yield.

Of this bull's daughters at Mr. Moreland's, the highest credit went to Golden Swan's Girl, which in 295 days produced 374·81 lb. fat as a two-year-old. Recognizing that this young cow could



GOLDEN SWAN.



GOOD LUCK.

improve upon that performance Mr. Moreland continued her in test the following season. On this second season's work she has been credited to the end of April, in 253 days, with 9,448·40 lb. milk, containing 434·31 lb. butter-fat. Nor does the record of Golden Swan's Lilac do her justice, although she is credited with 314·60 lb. fat, commencing her record under two years of age. She, in her second year's test, is also doing better work. Another daughter doing her sire credit is Golden Swan's Lady. Her present certificate of record credits her with a yield of 276·79 lb. fat in 281 days, commencing at less than two years of age. Her second season's credit to the end of April, for 304 days, is 8,744·30 lb. milk, containing 468·84 lb. butter-fat.

At the time of writing the highest-record daughter of Golden Swan is Snow Bird, owned by Mr. C. A. Willis, of Pukekohe. This heifer commenced milking at the age of two years five days, and produced 395·16 lb. fat. Although a very creditable performance, it also is likely to be superseded by this cow on her second season's work. Doubtless, Golden Swan's progeny will be held in even higher esteem as they attract attention to their powers of production.

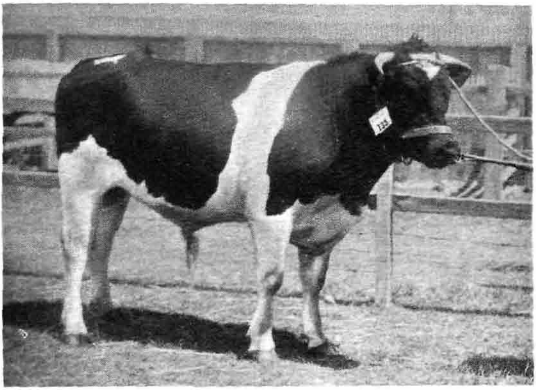
Good Luck.—The C.O.R. daughters of Good Luck were all owned and tested by Mr. C. Stevens, of Maungatapere, North Auckland. Their productions were made under conditions not the most favourable for making the best records, and still the figures are creditable.

Ava, in 363 days, as a three-year-old, produced 366·40 lb. butter-fat, and as a yearling Lucky Dorothy produced 311·99 lb. fat. In the two-year-old class Lady Hope III produced 319·80 lb. fat; and Allie, as a three-year-old, produced 327·65 lb. butter-fat in 344 days.

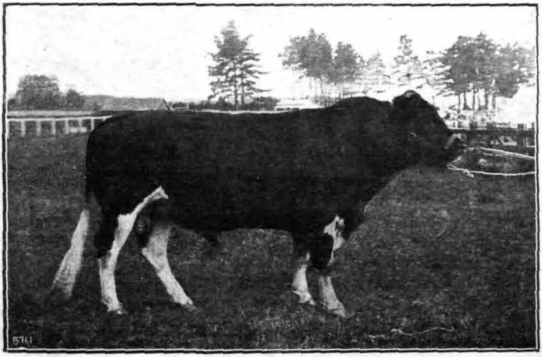
Eminent's Fontaine.—Owing to the late arrival of a declaration one of the daughters of Eminent's Fontaine, finishing her record during 1915, was not included in the number credited to this bull n the February issue of the *Journal*. This bull's credit should therefore read as six C.O.R. daughters having qualified during 1915, and ten C.O.R. daughters since the commencement of the testing-system.

FRIESIANS.

Longbeach Van Tromp.—The name of this sire, which was bred and owned by Mr. J. C. N. Grigg, of Longbeach, is as well



LONGBEACH VAN TROMP.



NETHERLAND KING.

known amongst New Zealand Friesian breeders as that of any other bull of the breed. Despite the fact that his daughters were represented in a considerable number of herds, few have been tested for a record. He has five C.O.R. daughters, four of which have qualified at the Weraroa Experimental Farm, and one at Mr. C. Hopping's.

The record of Longbeach Ideal is the most outstanding amongst Van Tromp's daughters. This cow as a three-year-old produced 633·85 lb. butter-fat, and has been purchased by Mr. C. A. Hopping from his father. Lenore has the best record of the four C.O.R. daughters at Weraroa. She was in milk 365 days, and has a record of 481·29 lb. butter-fat. Gretchen has the next-best record. She was in milk for the comparatively short milking-period of 314 days, and produced 426·81 lb. fat. Other C.O.R. daughters are Julia and Dominion Domino's Pride, neither of which milked the full year, but produced 380·47 lb. and 372·80 lb. fat respectively. The Weraroa productions were made under herd conditions, with twice-per-day milking.

The pedigrees of Longbeach Ideal and Dominion Domino's Pride are very good examples of line breeding. In each case the transmissible factors of a sire named Thumper have been concentrated. Breeders will recognize in Thumper the sire of Domino III, the latter a name well known among the fanciers of black-and-whites.

Netherland King.—Netherland King also was bred at Longbeach, and doubtless this bull received from his ancestors many hereditary factors similar to those received by Longbeach Van Tromp. Both of these bulls are, through various lines, rich in the blood of such progenitors as Taureau (Imp.) and Netherland Queen (Imp.), and have at least 50 per cent. of their breeding in common. Netherland King was purchased by Mr. John Donald, of Westmere, who used him as the head of his herd for some time. All the C.O.R. daughters of Netherland King were tested young, and none were milked their full 365 days, the average milking-period being 310 days. The best record is held by White Rosette, with a credit of 423·75 lb. fat in 292 days, as a three-year-old. Netherland Pauline, as a three-year-old, in 322 days produced 380·41 lb. fat. Netherland King's other two C.O.R. daughters are Netherland Pride, with a record for 308 days of 331·71 lb. fat, and Netherland Duchess III, with a record of 319·84 lb. fat in 317 days. Each of these is in the three-year-old class.

WATER-SUPPLY ON THE FARM.

UTILIZING SPRINGS.

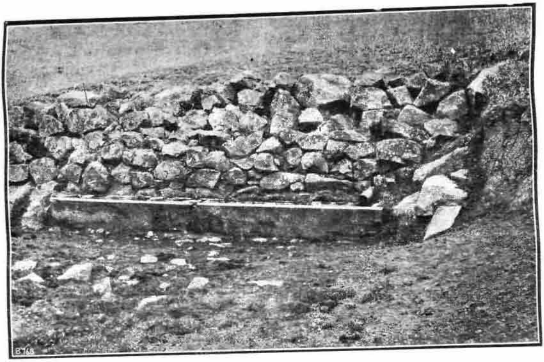
JOHN D. RITCHIE.

THE matter of a pure and ample water-supply for domestic and live-stock purposes is one that does not receive from the farming community the attention that its importance warrants. During the recent prolonged dry weather experienced in a large part of the South Island the want of water, especially for stock, was very

A WELL-CONSTRUCTED TROUGH AND SURROUNDINGS.

severely felt, and considerable losses resulted. Dams, which at the best are merely makeshifts and harbours for parasites, were in many instances dry, and even the flow from springs was greatly diminished.

It is to be deplored that greater use is not made of the source of water-supply furnished by springs. If properly conserved, the merest trickle will go a long way to keep a trough full. The cost of draining and providing a trough should not be great. The site for the trough, where the configuration of the country will allow

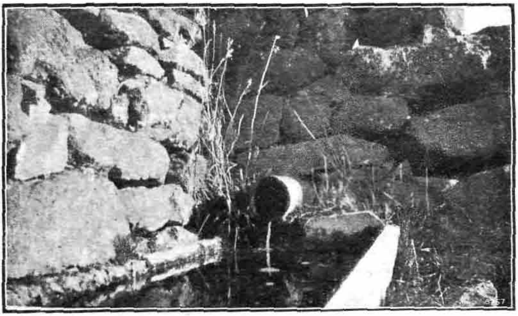


A GOOD TROUGH OF SIMPLER WALL-CONSTRUCTION.

WELL-BUILT-UP WALL WITH PROTECTIVE NETTING AT BACK.

of the draining of the springs by gravitation, should be fixed on solid ground and, if possible, face the north. The drain should be carried a little beyond the apparent source of supply, otherwise the spring may not be properly tapped. Ordinary field-drainpipes are suitable, but where the flow is limited second-hand glazed pipes will be better. Stones should be used to fill up the drain at the source, and if plenty are available a layer on top of the field-pipes will be an advantage. Manuka scrub will serve this purpose if stones are not available. The inlet-pipe into the trough itself should be of metal.

The photos here shown, taken at two well-known South Canterbury and North Otago stations on which the method now described



A SMALL SPRING FILLS THE TROUGH.

is extensively and successfully used, will give some idea of how the troughs and their surroundings should be constructed. If concrete is used for the troughs, then the back and side walls should be of the same material. Where the inlet-pipe passes through the wall care should be taken to see that it does not rest on the solid, for it may sink slightly as the drain settles, and may, besides, have to be renewed. Concrete troughs should be about 14 ft. long by 2 ft. to 2 ft. 6 in. wide, and not exceeding 1 ft. deep. Wooden troughs cannot well be made so wide, and should measure, say, 14 in. at top and 10 in. at bottom. It is very essential that an overflow drain should be provided and carried well away from the trough. The ground in front of the trough should be concreted or laid with stones, so as to prevent puddling by the stock.

NOTES ON A FORM OF NERVE DERANGEMENT IN HORSES.

C. J. REAKES, D.V.Sc., M.R.C.V.S., Director, Live-stock Division.

SOME interesting cases of nerve derangement have occurred lately among horses in certain parts of the Dominion, principally in North Canterbury and in the immediate neighbourhood of Christchurch. A few others occurred in South Canterbury and on two farms in the Wairarapa, several miles apart. Though this is the first time any general attention has been drawn to this trouble, the inquiries which have been instituted have elicited the fact that occasional cases have occurred before in the North Island.

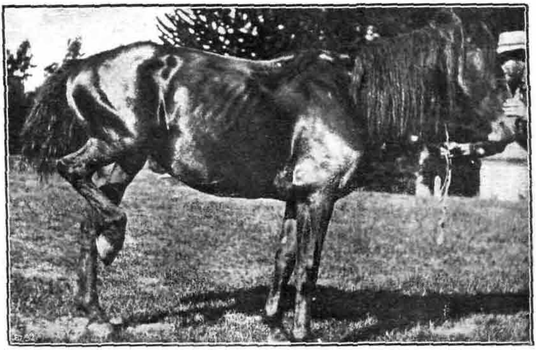
The affection is distinct from that which has been noted as a result of ergotism or of feeding upon the ripe heads of certain varieties of rye-grass, *Lolium temulentum* in particular. Though its immediate causative agent is as yet undetermined, and is proving extremely difficult to discover, it is evidently a trouble whose onset is influenced by climatic conditions, all the cases which are known to have occurred having arisen in districts where an altogether unusually hot and dry summer has been experienced.

The symptoms are not identical in every instance, they apparently varying according to the severity of the attack; but the most usual and prominent is an exaggerated form of stringhalt (see photographs), sometimes accompanied by a gradually developing well-marked wasting of the muscles of the hind limbs. In some instances, usually in younger animals, this is not so noticeable, and a knuckling-over of the fetlocks of the fore or of both fore and hind limbs is frequently observed. In the most severe cases the animal goes down and is unable to rise without assistance, though actual paralysis of the hind quarters does not exist.

Though the present is the first occasion on which this trouble has manifested itself in the Dominion to a sufficient extent to have been brought under the notice of the Department, it is well known in Australia, and in veterinary text-books is described under the term "Australian stringhalt." Mr. H. S. S. Kyle, Veterinarian in the Department, has seen cases in Australia, and is clearly of opinion that the affection now under notice is identical with this. In Australia it is not regarded as an infectious disease, and our observations and investigations here have afforded no cause for

differing from this opinion. The cause is evidently some toxic (poisonous) agent which acts directly upon the nervous system by causing a lack of control and co-ordination of muscular movements, and does not affect the appetite or the general functions of the digestive and urinary systems. It may, however, cause disturbance of the respiratory functions, affected animals, when forced to quick exertion for a little time, sometimes showing distressed and stertorous breathing.

A careful investigation is being carried out in an endeavour to determine how this toxic agent is produced, and it is already evident

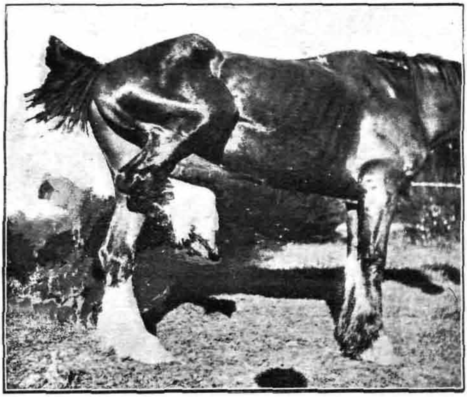


HORSE SHOWING CHARACTERISTIC EXAGGERATED FORM OF STRINGHALT.

that this is going to be a difficult matter, calling for very thorough and systematic work. In Australia, according to latest advices, the cause, though not yet definitely determined, is believed to be of dietetic origin, and it is especially noticeable that there the trouble is most common in the driest seasons. No form of treatment has yet been found which will bring about quick recovery, but in all but acute cases, where death may occur within a few days, recovery takes place after the expiration of a long period, often as much as twelve months. We are at present experimenting with various forms of medicinal treatment, and any owners of affected horses should apply to the Department for the services of a Veterinary Officer in advising and assisting in the treatment of the animals

if no available qualified veterinarian in private practice be available. *Then all that we can do will be done.*

One noticeable feature is that the affection is not limited to horses grazing on pastures, a few cases having occurred among stable-fed horses, which certainly have been allowed to run outside at night, but only in small enclosures where little or no herbage was present. In this connection feeding experiments have been carried out at Wallaceville Veterinary Laboratory with chaff on which affected animals had been fed, but these have given entirely negative results.



ANOTHER CASE OF EXAGGERATED STRINGHALT.

Investigations are being carried out on various lines, especially in the direction of endeavouring to determine whether any form of vegetable mould may be responsible, and in this Mr. A. H. Cockayne, Biologist to the Department, with his staff, is co-operating and rendering valuable aid. That moulds are capable of exerting a poisonous action upon the lower animals is a well-known fact, and this action is especially exerted upon the nervous system.

A careful observation is being kept on the Canterbury cases by Mr. J. Kerrigan, Veterinary Supervisor, and Mr. W. C. Barry, Veterinarian, together with Inspectors F. Mackenzie and J. Munro, and every endeavour is being made to get to the bottom of the trouble. In addition to the work at Wallaceville, experimental

medicinal treatment is being carried out by the above-mentioned Veterinary Officers, and Mr. Kyle and Mr. A. M. Paterson (Veterinary Inspector at Timaru), and, in spite of the obscurity of the immediate cause of the trouble, it is hoped that good results will accrue.

In view of the evident identity of the trouble with so-called Australian stringhalt, it will be of interest to reproduce a portion of an address on "Shoeing and Stringhalt," given by the late Professor McCall before the National Veterinary Association, London, at the annual meeting of that body in 1910, as follows :—

AUSTRALIAN STRINGHALT.

This disease, which in some respects resembles stringhalt in Great Britain, appears to be peculiar in Australia, where it affects large numbers of horses in certain districts. We are indebted to Professor W. T. Kendall, of the Melbourne Veterinary College, and Mr. Edward Stanley, F.R.C.V.S., for particulars of this malady. The following extracts and notes are made from veterinary reports furnished by them to the Minister of Agriculture for Victoria.

In 1865 or 1867 the disease appeared in Victoria. It seems to follow in the wake of agriculture, and breaks out most frequently in paddocks which have been ploughed and then laid down to grass. As a rule it prevails in low-lying rich lands, and it always comes on suddenly without any assignable cause, and usually about the autumn.

Professor Kendall considers that the malady has three forms—namely, local, general, and acute general.

The local form is the most common, and "is characterized by a peculiar jerking action in one or both hind limbs, which may be so slight as to be only noticeable when the animal is suddenly turned round or made to go backwards; but in more severe cases both hind legs may be so badly affected that progress can only be accomplished by a succession of bounds and plunges extremely painful to witness." In cases where both legs are badly affected, when the horse desires to move forwards the hind quarters are suddenly elevated, and one hind leg is violently jerked upwards, sometimes so high that the foot strikes the belly and remains so drawn up; the other is then brought up in a similar manner, the former being at the same time suddenly brought to the ground with great force. At other times both hind legs will be jerked up simultaneously, or in quick succession, and the hocks remaining flexed to their utmost extent, until the haunches almost reach the ground, before the horse has power to bring the feet down.

The appetite is almost invariably good, and the digestive and urinary organs appear to perform their functions properly. This form of the disease seldom proves fatal, and affected animals gradually recover without treatment in from twelve to eighteen months.

General Form.—The fore limbs are generally affected as well as the hind ones, but instead of being jerked up like the latter they are carried stiffly forward, the knee being scarcely bent at all. When undisturbed a horse affected in this manner may graze and get about without much

difficulty, but cannot get along at all when chased or excited, but begins to plunge and flounder about; some fall, and others, after making violent struggles to get away, come to a sudden standstill, their heads being elevated and nostrils dilated. If near enough the heart may be heard beating violently.

Acute Form.—The symptoms differ differently from those of either of the other forms, but as all three are found affecting different animals in the same mobs at the same time and under precisely similar circumstances, it is evident that they are only modifications of the same disease.

There is a dragging in all the limbs and frequent stumbling, the hind fetlocks knuckle over, and the thighs have a thin, wasted appearance when viewed from behind. If the horse is made to move any distance he breaks into a perspiration. The attack is usually very sudden. Should the horse fall or lie down he may be unable to rise, and struggles violently; but if raised by means of slings he can both stand and walk, and if properly attended to he usually recovers.

Treatment.—Change of pasture, as well as of locality, is one of the surest means not only of preventing the disease, but also for hastening recovery in those already affected. Medicinal treatment is of doubtful benefit.

Causes.—Eating of so-called dandelion, metallic poisoning from venadium, intestinal worms, rheumatism, ticks, and flies have all been credited with being responsible for the disease; but, upon close investigation, the evidence necessary to incriminate any one of these has been found wanting.

IMPORTATION OF FERTILIZERS.

ANNUAL RETURNS.

B. C. ASTON, F.I.C., Chemist to the Department.

THE returns of fertilizers imported into New Zealand for the year ended 31st March, 1916, are now, by courtesy of the Comptroller of Customs, available, and have been classified according to the scheme drawn up last year (see *Journal* for August, 1915), which may be compared with the current figures. Several important and instructive points in which the table differs from that of the previous year may be first noted.

Potash salts have, as might be expected from a knowledge of the country of origin (Germany), decreased almost to the vanishing-point. Only 96 tons have been imported, as against 4,148 tons in the previous year and 4,546 tons the year before the war. As a partial set-off against this deficiency of potash imports may be placed gypsum, which has increased from 4,374 tons for the latest

complete year without war to 6,314 tons in 1915, and to 8,182 tons during the year under review. Gypsum, or sulphate of lime, as is well known, in its action is an indirect potash fertilizer, liberating the inert potash of the soil silicates.

Basic slag, a favourite top-dressing fertilizer for pastures, shows a great diminution, falling to what is practically one-third of the amount for the previous year or the year before that. All the other phosphate fertilizers, however, show a marked increase, so that to make up for the 20,000 tons deficiency of basic slag there were imported 24,000 tons increase of other phosphatic fertilizers, about half of which would contain a similar quantity of phosphate, and the other half much more. It cannot therefore be said that there was a great deficiency of phosphates. Moreover, the year was not one in which the settlement of lands would require much higher amounts of phosphates to be used. Farmers, however, are becoming more alive to the value of the phosphatic fertilizers, and if the demand exceeded the supply it would be more to this cause than to any other.

The following is a summary of the kinds, quantities, and values of the various fertilizers imported into New Zealand during the years ended the 31st March, 1916 and 1915:—

—	Weight.		Value.	
	Year 1915-16.	Year 1914-15.	Year 1915-16.	Year 1914-15.
	Tons.	Tons.	£	£
Bonedust	10,059	7,966	64,177	52,235
Bone char	906	686	3,209	2,270
Blood manure	109	251	727	1,650
Blood and bone	808	798	5,570	5,195
Basic slag	10,339	29,385	38,892	97,716
Egyptian basic phosphate ..	2,026	..	7,562	..
Superphosphate	58,013	54,190	231,007	196,009
Guano and rock phosphate ..	39,366	23,983	96,449	64,881
Phosphate unspecified	2,139	841	4,144	2,875
Sulphate of potash	92	1,196	2,342	14,606
Muriate of potash	..	13	..	151
Kainit	4	1,962	81	6,699
Potash salts unspecified.. ..	..	977	..	5,757
Gypsum	8,182	6,314	12,010	9,953
Sulphate of ammonia	845	590	11,013	8,640
Nitrate of soda	659	545	6,842	6,411
Calcium cyanamide	181	60	2,050	611
Sulphate of iron	158	71	771	367
Manures unspecified	116	771	542	4,286
Totals	134,002	130,599	487,388	480,312

IMPORTATION IN TONS OF ARTIFICIAL FERTILIZERS TO NEW ZEALAND FOR

New Zealand Port of Entry.		Australia.					Belgium.			Germany (including Austria).					H
		Nitrogenous Manures.	Bonedust and Blood and Bone.	Superphosphate.	Rock Phosphate and Phosphate unspecified.	Gypsum.	Nitrogenous Manures.	Superphosphate.	Basic Slag.	Nitrogenous Manures.	Superphosphate.	Basic Slag.	Phosphate unspecified.	Potash Manures.	Superphosphate
uckland	1916	292	4,713	11,013	152	890	..	..	..	..	170	..	..	..	.
"	*1915*	*268*	*6,360*	*3,295*	*26*	*1,288*	*5*	*50*	*†610*	*5*	*10,970*	*8,639*	*305*	*858*	*3,*
overty Bay	1916	..	..	..	..	..	..	..	..	..	..	..	..	..	.
"	*1915*	..	..	*10*	..	..	..	..	..	..	*50*	*50*	..	*5*	.
aipara	1916	..	..	..	..	..	..	..	..	..	..	..	..	..	.
"	*1915*	..	*40*	..	..	..	..	..	..	..	..	..	..	..	.
ew Plymouth	1916	32	..	1,415	340	..	..	..	..	..	..	..	..	..	.
"	*1915*	*20*	*124*	..	*200*	*190*	..	..	..	..	*900*	*687*	..	*220*	*1,*
atea	*1916*	..	..	..	..	100	..	..	..	..	..	..	..	..	.
"	*1915*	..	..	..	..	*40*	..	..	..	..	*80*	..	..	*20*	.
anganui	1916	5	45	..	..	..	..	..	..	..	..	..	..	..	..
"	*1915*	..	..	*1*	..	*10*	..	..	*15*	..	..	..	..	*5*	.
ellington	1916	27	..	7,990	1081	430	..	..	..	..	102	..	..	..	*
"	*1915*	*43*	*20*	*15*	*536*	*496*	..	..	*20*	..	*1,345*	*1,294*	*210*	*776*	*4*
apier	1916	35	..	596	50	45	..	..	..	..	..	..	..	..	..
"	*1915*	*25*	..	..	*15*	*111*	*2*	*25*	*49*	..	*200*	..	*25*	*150*	.
airau and Picton	1916	..	..	..	..	..	..	..	..	..	..	..	..	..	.
"	*1915*	..	..	..	..	..	..	..	..	..	*12*	..	..	..	..
elson	1916	3	..	30	..	..	..	..	..	..	..	..	..	..	..
"	*1915*	*18*	..	*70*	*10*	*20*	..	..	..	*14*	*75*	*99*	..	*55*	..
yttelton	1916	152	..	7,893	1560	3,548	..	..	..	..	..	..	..	..	..
"	*1915*	*5*	..	*1,563*	..	*1,267*	..	*550*	..	..	*650*	..	..	*556*	*1,*
imaru	*1916*	..	10	3,330	950	1,040	..	..	..	..	..	..	..	..	..
"	*1915*	*1*	..	..	..	..	..	..	*50*	..	*860*	*125*	..	*215*	*1,*
amaru	1916	..	..	675	..	300	..	..	..	..	..	..	..	..	..
"	*1915*	..	..	..	..	..	..	..	..	..	..	..	..	..	..
unedin	1916	441	..	1,697	625	321	..	..	..	..	..	..	..	..	..
"	*1915*	*331*	*123*	*79*	*2*	*2,539*	..	..	*25*	*100*	..	*50*	..	*140*	
vercargill	1916	477	874	1,416	1325	1,070	..	..	..	..	..	67	..	..	1,1
"	*1915*	*178*	*454*	*2,809*	*775*	*350*	..	..	..	..	*25*	*310*	..	*894*	*2,1*

* Phosphate unspecified. † Includes 50 tons phosphates unspecified.

NDED 31ST MARCH, 1916 AND 1915, SHOWING COUNTRIES OF DEPARTURE.

ndia.	Japan.	Pacific and Indian Ocean Islands.		Scandinavia.	United Kingdom.						United States.		Eg
Bonedust.	Superphosphate.	Name of Islands.	Rock Phosphate.	Calcium Cyanamide.	Nitrogenous Manures.	Superphosphate.	Basic Slag.	Potash Manures.	Phosphate unspecified.	Iron Sulphate.	Nitrate of Soda.	Iron Sulphate.	
1,490	1,500	Seychelles Islands .. New Caledonia .. .. Tuamotu Archipelago .. Malden Island	2,500 1,790 15,673 120	..	..	1,837	3,018	4	60	..	50	..	
975	..	*Seychelles Islands* .. *Society Islands* .. .. *Tuamotu Archipelago* ..	*1,150* *28* *4,300*	..	*41*	*6,023*	*7,131*	*27*	..	..	*27*	..	
..	..	..	..	..	..	24	..	..	..	..	..	..	
..	..	..	..	..	..	*24*	*85*	..	..	..	..	..	
..	..	..	..	..	..	..	..	..	..	..	..	..	
..	..	..	..	..	..	..	..	..	..	..	..	..	
415	..	..	..	40	..	..	..	..	..	..	..	..	
526	..	..	..	*21*	..	..	*3,775*	..	..	..	..	..	
..	..	..	..	..	..	..	..	..	..	..	..	..	
..	..	..	..	..	..	..	..	..	..	..	..	..	
..	..	..	..	..	..	..	..	..	..	..	..	..	
..	..	..	..	..	..	*75*	..	..	..	..	..	..	
141	15	New Caledonia	1,000	115	..	641	6,154	..	..	..	..	..	
..	..	..	..	*37*	*15*	*829*	*3,438*	..	*70*	*2*	*6*	..	
..	2,375	..	..	11	..	50	..	..	..	..	..	..	
..	*1,600*	..	..	..	..	*154*	*195*	*10*	*1*	..	..	..	
..	..	..	..	..	..	..	..	..	..	..	..	..	
..	..	..	..	..	..	*80*	..	..	..	..	..	..	
..	..	..	..	..	..	30	100	..	..	..	..	..	
..	..	..	..	..	*32*	*140*	..	..	..	..	..	..	
..	3,195	Seychelles Islands ..	850	..	..	1,050	600	..	..	55	..	55	
..	*2,205*	*Madagascar*	*1,190*	..	..	*1,950*	*1,000*	..	*175*	..	..	*19*	
200	3,419	..	..	10	..	1,250	..	..	..	..	..	27	
100	*2,428*	*Madagascar*	*560*	..	..	*1,150*	*350*	..	..	..	..	..	
..	..	..	..	..	..	..	..	..	..	..	..	18	
..	..	.. ..	..	..	..	..	..	..	..	..	..	..	
125	104	Straits Settlements .. Seychelles Islands .. Tuamotu Archipelago ..	300 11,000 2,522	5	..	50	240	..	..	..	..	..	
75	..	*Straits Settlements* .. *Malden Island* .. .. *Madagascar* .. .. *New Caledonia*	*3,407* *2,431* *1,098* *1,449*	..	..	*489*	*435*	*10*	*315*	..	..	..	
675	4,475	Madagascar .. .. Tuamotu Archipelago ..	3,410 6,262	..	..	470	100	..	..	..	..	..	
625	..	*Straits Settlements* .. *Malden Island*	*2,422* *4,335*	..	*149*	*762*	*418*	..	..	..	..	..	

THE CHAFF-MITE.

METHODS OF CONTROL.

A. H. COCKAYNE, Biologist, and R. WATERS, Biological Assistant.

IT is only at certain times that chaff-mites belonging to the genus *Tyroglyphus* cause sufficient apparent damage to arouse any particular interest in their suppression. These mites, however, are of widespread occurrence in many agricultural products such as bran, flour, chaff, hay, cereals, grass-seeds and brassica seeds. When present in large numbers they cause great damage by actually destroying the material in which they are found. In many cases, however, the damage is not properly recognized, and no effort is made to keep the pest under control. On the other hand, especially with regard to chaff, the presence of mites in large numbers renders the fodder unacceptable to stock, and it becomes quite useless for feeding purposes. In seed-stores mites are often extremely troublesome, especially amongst turnip and rape seed.

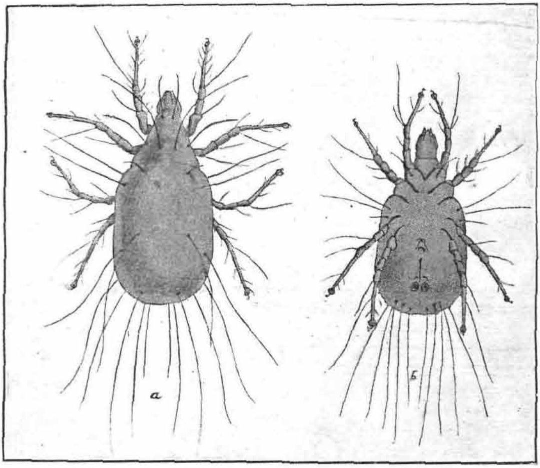
During August of last year a very severe attack of chaff-mite occurred in the fodder belonging to the Defence Department, stored in Wellington and awaiting shipment. The mites were present in such enormous numbers, especially in the bran and chaff, that it was feared that unless some special efforts were made to control the pest the whole of the fodder would be rendered useless for shipping. The material had been in store for some months, and it appeared as though the mites had been introduced in certain lines of chaff, and had spread from them until the whole of the shed was badly affected. A careful examination of the material was made, and it was found that the main damage was being done to the chaff and bran. The hay and oats, although affected, did not appear to be depreciating at the same rate as the bran and chaff. This was due to the fact that the hay, and more especially the oats, did not offer to the mites the same facilities for securing food.

As very little was known regarding methods of mite-control that could be applied on a large scale, a series of experiments were at once carried out to determine what, in the circumstances, was the best procedure to adopt. Many of the experiments were of a negative character so far as the immediate reconditioning of the many thousands of sacks of fodder were concerned, but as they

throw a considerable amount of light on the life-relations of mites they are here detailed.

EXPERIMENTS WITH VARIOUS METHODS OF CONTROL.

Heat.—The investigations into the penetrative power of heat through infested material, and into the powers of heat-resistance manifested by the mite, brought to light certain principles that could be applied in connection with the production of chaff and



(*a*) Female. (*b*) Male.

CHAFF-MITE (TYROGLYPHUS LONGIOR). GREATLY ENLARGED (AFTER CANESTRINI).

its subsequent management. A sack of chaff was subjected in a heating-room to temperatures ranging from 160° to 178° F. Separate thermometers were placed respectively in the heating-room and at 1½ in., 3 in., 4½ in., and 6 in. depth into the sack. The test was commenced at noon and terminated at 8 p.m. After the sack had been subjected for eight hours to a temperature of 170° F., the temperature 1½ in. within the sack was 114° and 6 in. within the sack 92°. While the differences between the temperatures of the thermometers at 1½ in. and at 6 in. in the sack had gradually

increased up to 5 p.m., such difference had begun to diminish by 8 p.m., and would doubtless have eventually become nil some time after the thermometer at 1½ in. deep had attained its maximum temperature. The difficulty of raising sufficiently the temperature of a sack of bagged chaff by firstly covering that stack with tarpaulins and thereafter introducing into it a continuous and large supply of heated and dehydrated air was thus manifested—chaff being such a poor conductor of heat.

The mites, being very watery and soft-bodied, showed very little power of heat-resistance. A quantity of the pests subjected directly to the comparatively low atmospheric temperature of 140° F. all died in five minutes. Again, a quantity of mites exposed for one hour to the direct rays of the sun (temperature 80° F.) all died. In this case the destructive effects of light may also have been at work. In this experiment, as in those with light, the mites showed a tendency to shelter in shaded positions.

As the mites succumb at such comparatively low temperatures, the application of heat in combination with sieving and blowing or with chaffing is a matter that may prove worthy of consideration if the pest should appear in such numbers as to demand special treatment. The destructive effects of sunlight, on the other hand, would doubtless suggest to producers troubled with this pest some simple methods in their practice which would serve to reduce or exterminate mites in straw or chaff. If the necessity for treatment were sufficiently pressing, an appliance could doubtless be devised by which even bagged chaff could very rapidly be unbagged and passed through a heated chamber, and delivered back into sacks free from living mites or mite-eggs.

Cold.—A sack of chaff, mite-infested, was placed in a chamber at 27° F. at noon on the 1st September. At noon on the 2nd September the temperature at the centre of the chaff in the sack was 40° F., with the mites living. The sack was then taken into a chamber at zero. At 10 a.m. on the 3rd September the temperature at the centre of the chaff was 17° F., and no living mites could be found.

Light.—A quantity of mites were taken into a dark room and were there exposed to the rays of a 250 candle-power arc lamp. The atmospheric temperature about the mites was 64° F. All were quite dead in two hours.

Pressure.—Only negative results were obtained from experiments under this head. Half a dozen sacks of chaff were subjected in a wool-press to pressure rising gradually to 35 tons, when the sacks burst—mites still living in large numbers.

Hydrocyanic - acid Gas (*Prussic - acid Gas*, HCn). — As is well known, this is one of the most destructive gases to animal life. It

is the gas commonly used in the fumigation of imported fruits, vinehouses, insect-infested dwellings, &c. Its power of penetrating sacks of chaff, however, was unsatisfactory, though its effects when brought directly in contact with the pests would no doubt be destructive. A number of experiments were made upon three sacks —one being opened at the mouth. Finally the large amount of 6 oz. of cyanide of potassium, with the requisite amount of sulphuric acid and water, was used in 100 cubic feet of space for two hours, when the mites were found to be still living.

Sulphur-fumes (SO_2).—The same three sacks as had been used for the hydrocyanic-acid-gas experiments were subsequently submitted to the fumes of two sulphur candles for twelve hours in the same airtight chamber—mites still living. The relatively low penetrative power of this gas was also doubtless the cause of failure, as the mites when exposed directly to these fumes succumbed in about one hour.

Carbon Disulphide (CS_2).—Three sacks were taken, and 6 oz., 12 oz., and 18 oz. respectively of the material was poured into the open mouths of the sacks, which were then sewn up and wrapped in a tarpaulin. After twenty-four hours some of the carbon disulphide was still unvolatilized, and many living mites were found in each sack. Seventeen hours later the following results were observed: The carbon disulphide was volatilized, there being a strong smell of the gas. Twelve tests with a trier were then made at various parts of each sack. Two living mites were withdrawn from the top of the sack treated with 6 oz., two from the top of the 12 oz. sack, and one from the bottom of the 18 oz. sack. The sacks were standing upright, and the penetrative power of the heavy gas in these circumstances was much more satisfactory. The opening of all infested sacks was a matter which time did not permit of prior to shipment.

Carbon Dioxide (CO_2).—Laboratory experiments showed that this gas was destructive when applied directly to the mites.

Mechanical Measures.—It was noted that the mites were often particularly abundant in the material of the sacks themselves. This no doubt accounts for the fact that an improvement in the condition of infested chaff may be seen when it has been transferred from one place to another, the mites being shaken off the outside of the sacks in large numbers, and egg-laying also thus being reduced.

Trials with hand-sieves showed that if infested chaff received a similar shaking to that applied to seeds in seed-dressing, the mites, as well as any dust present, separated readily. No mites were found in infested chaff after it had been well shaken in a sieve composed

of round holes of 1 millimeter in diameter. 8 oz., or 227 grams, of infested chaff yielded 1·52 grams of dust and mites.

METHOD EMPLOYED FOR BULK TREATMENT OF CHAFF.

After the comparatively satisfactory results resulting from carbon-disulphide fumigation, it was decided to employ this method on about sixteen thousand sacks that represented the worst-affected of the lines which could not be safely shipped owing to their extremely mitey condition. The application of heat or cold would, of course, have necessitated special accommodation and apparatus, and for so large a quantity of material would have been extremely expensive. Any method, too, that required the rebagging of the chaff was clearly out of the question for this occasion.

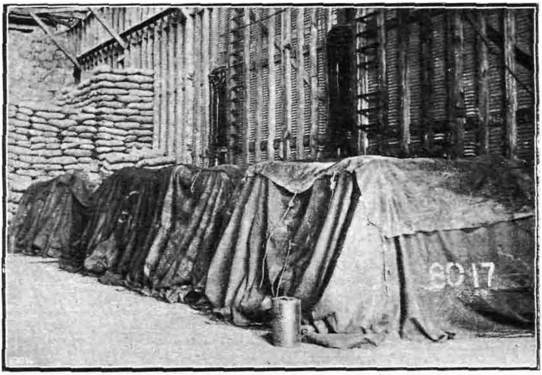
About ten days before the proposed shipment of the chaff the shed was made as airtight as possible, and some 40 gallons of carbon disulphide was poured into the various stacks from the top. The liquid was well distributed and volatilized rapidly, necessitating considerable speed in the application of the material. The sides of the stacks were also sprayed with carbon disulphide through a Bordeaux nozzle, but this part of the work had to be curtailed owing to the overpowering effects of the fumes. After the carbon disulphide had been applied the only exit from the shed was battened up. Owing to the extremely inflammable nature of carbon disulphide every possible precaution was taken, and the shed was carefully guarded throughout the fumigation. The fumes escaping from the shed were quite strong five hours after the application of the material, and when the place was opened next day the smell was distinctly noticeable in the vicinity of the treated stacks. In fact, nearly a week afterwards, when the stacks were being broken down, the disagreeable odour of carbon disulphide was present.

The effect on the mites appeared to be that many were driven to the outsides of the sacks, where they perished. While it could not be claimed that the fumigation exterminated all the mites, yet it certainly was instrumental in limiting any increase of the pests and rendered the chaff perfectly safe to ship. The whole of the chaff, with the exception of some 150 sacks picked out as likely to cause recontamination, was shipped, and arrived at its destination in excellent condition. The cost of the fumigation was extremely low, being less than 1s. 6d. per £100 worth of material treated.

TREATMENT OF INFESTED BRAN.

The mites were found particularly abundant in a large stack of bran, in which they appeared to thrive, owing to the large amount of food easily available to them in a powdery form. The stack

was sorted over, and all seriously affected sacks were made up into five small stacks each about five or six sacks high. These were stacked somewhat loosely, to facilitate the percolation of the gas. Each stack was well covered all round with tarpaulins, which on top were folded back preparatory to the application of carbon disulphide. As soon as the liquid had been applied these top covers were drawn over, and the stacks were left overnight to fumigate. As with the chaff, it was noted that after treatment the mites came out through the sacking in considerable numbers for some days afterwards and fell to the ground, all such being swept



BRAN-STACKS COVERED WITH TARPAULINS.—CARBON-DISULPHIDE FUMIGATION IN PROCESS.

up daily and destroyed. Owing to the denser nature of bran it was considered that the gas would not penetrate as readily as through chaff, this being the reason for making up smaller stacks. The fumigation of the bran certainly resulted in a very appreciable reduction in the numbers of the pest, sufficient at least to enable the military authorities to thereafter dispose of the fodder according to their requirements.

GENERAL RECOMMENDATIONS.

It is well recognized that the subject which is being dealt with is important enough to warrant very much closer attention than

there has been opportunity so far to devote to it, and the intention is to further pursue the subject of treatment as the opportunity offers. In the meantime the remedial measures that have been suggested by the previously mentioned experiments are now outlined for general information.

The mere removal of chaff from one place to another is in itself a ready method of improving its condition so far as mites are concerned. Thus large stocks that are intended to remain a long time in one position are much more liable to a bad outbreak than smaller ones that are being constantly removed and replaced by fresh supplies. It should here be noted that the mites are very generally present in great numbers in the fabric of a badly infested sack of fodder material, and that with practice the condition of that sack may be readily determined by the animal smell on the hand after it has been rubbed over the sack. By this action, moreover, the crushing of numerous mites lends a distinctly wet and sticky feeling to the sack.

The fine hairy parts of a sack are frequently found to be covered with mite-eggs; hence the use of sacks which have previously held fodder or meal of any kind—particularly flour and the like—should be abandoned as far as possible. The exposure of infested sacks to the sun would doubtless greatly improve them, but so far little is known as to the capacity of the mite-eggs for resisting unfavourable conditions. The use of carbon disulphide as a fumigant for empty and infested sacks is to be recommended.

One of the simplest methods of dealing with a badly infested line of chaff is to sieve it. With sufficient shaking the mites and many of the eggs may be separated from the larger particles to which they are clinging or attached, or fall through with the finer dust and hairy matter. In the experiments carried out a sieve made of circular holes 1 millimeter in diameter was used, but doubtless a large mesh could be employed with advantage and without undue loss. A purchaser of a bad line might well use this method; if necessary, leaving the chaff so treated a short time to sweeten before offering it to live-stock.

The conditions under which fodder of all kinds, including hay, are stored is a matter that deserves close attention. The admission of an abundance of circulating air and of light is highly desirable, but most important is the need for good dry conditions in the store. One of the chaff-stacks that was dealt with as above recorded was built round a hydraulic jigger, at the base of which was an iron drain to carry away any water that might fall from the joints higher up. This drain had become blocked by the chaff that had fallen through several rat-holes in the surrounding sacks.

There was consequently a constant uprising of water-vapour from the overflowing drain and wet floor below. Nearly all the sacks exposed to these damp conditions had to be held back from shipment, owing to the extent to which they were infested by mites, particularly on their exposed surfaces.

Carbon disulphide is commonly used in grain-mills for fumigation purposes at the rate of about 1 lb. to every 1,000 cubic feet of space, but for the treatment of stacks of bagged fodder a much heavier application is preferable to ensure quicker penetration. In the method finally adopted material up to 5 lb. per 1,000 cubic feet was used. The gas into which this clear liquid volatilizes is heavy as compared with the atmosphere; applications should therefore always be made to the tops of stacks. The more limited and confined the area to be fumigated can be made the better; small stacks may be covered with some suitable material. The buildings in which extensive fumigation is being done should be made as airtight as possible. The longer the gas is allowed to remain undisturbed the further it may be expected to penetrate into the sacks. The main objection to the use of this fumigant is its very highly explosive nature, and every precaution must be taken that no spark of any kind of fire or heat shall come in contact with the gas. The flash at the switch of an electric-light button has been known to create a big explosion.

A diversion from the ordinary method of stacking could well be made in order to facilitate the fumigation of chaff-stacks. A scheme was devised by which smaller stacks were practicable, and stacks provided with air-channels throughout might be formed to this end. The use of insulated meat-vans as fumigation-chambers was proposed, but, as described in the case under notice, large tarpaulins were used for confining the fumes about the smaller and worse-affected stacks of fodder such as bran.

NATURAL ENEMIES.

Little is at present known of the various kinds of mites to be found in infested chaff-samples. Besides the smallest and commonest hyaline mites, other much larger and variously marked mites were observed. It is not improbable that some of these larger kinds are parasitic on the smaller.

As with all the other work performed in connection with this particular outbreak, however, the extent to which the observations and experiments were carried was limited by the fact that the best possible conclusion had to be arrived at and acted upon in the space of about fourteen days, when the military authorities were obliged to ship.

TURNIP-FLAVOUR IN MILK.

PRELIMINARY OBSERVATIONS AT WERAROA.

DURING the end of February and the beginning of March of this year some observations were made at Weraroa Experimental Farm regarding the effects on milk-flavour of feeding to cows a number of different varieties of turnips. The object of the tests was to discover what variations, if any, existed amongst the varieties with regard to their power of communicating turnip-flavour to milk, with a view to selecting one or more varieties for further work on this subject. Accordingly, no effort was made to minimize the effect of feeding the varieties by limiting the amount fed, or by adding to the turnip ration other foods which might have the effect of reducing or disguising the undesired flavour.

The varieties used were: Perfection Green-top, Centenarian Green-top Hybrid, Favourite Purple-top, All the Year Round, Green-top Six Weeks, Red Paragon, Imperial Green Globe, Purple-top Mammoth, Early Six Weeks, Pomeranian White Globe.

There was practically no difference in weight of crop in any of the varieties, and all showed the same tendency to go off very rapidly after coming to maturity. Each variety was made the subject of a separate test for flavouring properties.

The turnip-flavour in the milk was not so marked as to be objectionable in any of the samples immediately after milking, but it developed on keeping. When 60 lb. of turnips per cow was fed at 8 o'clock in the morning the turnip-flavour in the evening's milk on keeping was quite decided. When 50 lb. per cow was fed at 5.45 p.m. the flavour developed in the morning's milk on keeping was not marked. The hours of milking the test cows were 6.45 a.m. and 5 p.m.

No variety produced milk which was entirely free from slight odour on keeping, and most of the varieties produced milk which had decided odour and objectionable flavour. Purple-top Mammoth, Favourite Purple-top, and Centenarian Hybrid were comparatively free from tendency to produce odour and to flavour the milk on keeping. Samples of butter made from the milk of cows fed on these varieties had, however, a slight turnip-flavour. These varieties will be used freely in further experiments.

The testing and sampling of the milk was very carefully done by Miss G. N. Davies, N.D.D., of the Department's staff.

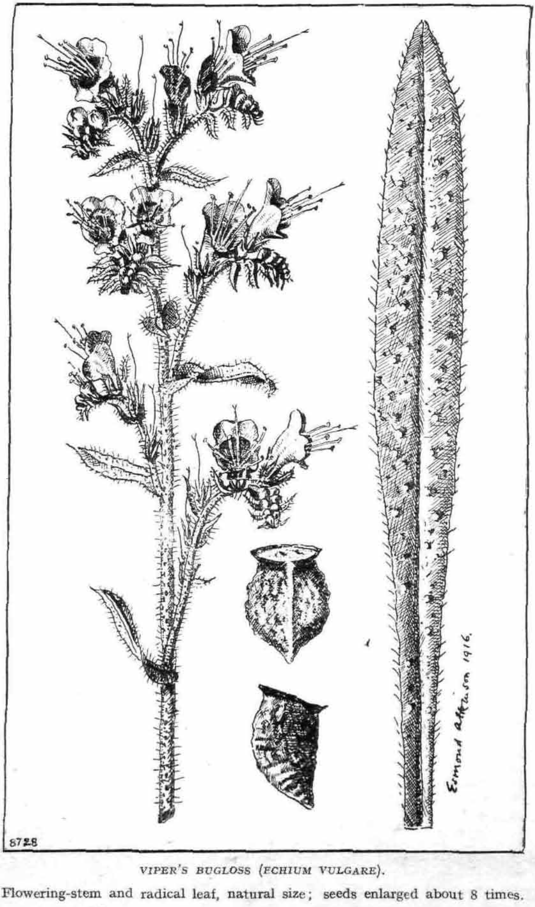
WEEDS AND THEIR IDENTIFICATION.

CONTINUED.

ESMOND ATKINSON, Biological Assistant.

VIPER'S BUGLOSS (ECHIUM VULGARE).

General Description.—Viper's bugloss, which belongs to the same family as the borage and forget-me-not, is one of the most easily recognizable of all our weeds from its very conspicuous brilliant blue flowers, which in places where it is abundant form quite a feature in the landscape. The plant is generally ranked as a biennial in other countries, but in New Zealand it very often assumes the perennial habit. The roots are stout and tapering, and penetrate deeply into the soil. Young plants bear a crowded rosette of radical leaves, but, as the flowering-stems develop, this rosette character becomes less obvious. The stems are not numerous as a rule, nor are they much branched normally. The cutting of the stems, however, stimulates the formation of branches to a marked degree, and plants may often be seen with their original flower-stalks cut off low down, but with densely clustered secondary stems springing from below the cut, showing the futility of attempting to prevent seeding by merely cutting off the stems. The leaves are long and narrow, pointed at the tip, and, like the stems, are covered with raised points or tubercles and with numerous whitish bristly hairs. The main stem bears a number of flower-spikes, which (as is usually the case in the forget-me-not family) are one-sided and incurved at the tips. Examination of a plant in full flower will show that each spike bears buds at its tip, then open flowers, and finally, at the base of the spike, ripening fruits. Late in the season, through the elongation and straightening of the flower-spikes, the plant alters a good deal in appearance. The buds are rosy-pink, but the colour changes as development proceeds, until in the fully expanded flower it is a deep clear blue. Each flower consists of a five-lobed bristly calyx, and a five-lobed irregularly funnel-shaped corolla from the throat of which spring the five stamens. The ovary is four-celled, and bears a long slender style which is two-lobed at the tip. There are four seeds, which after the corolla has fallen remain enclosed in the calyx. The seeds are



VIPER'S BUGLOSS (ECHIUM VULGARE).

Flowering-stem and radical leaf, natural size; seeds enlarged about 8 times.

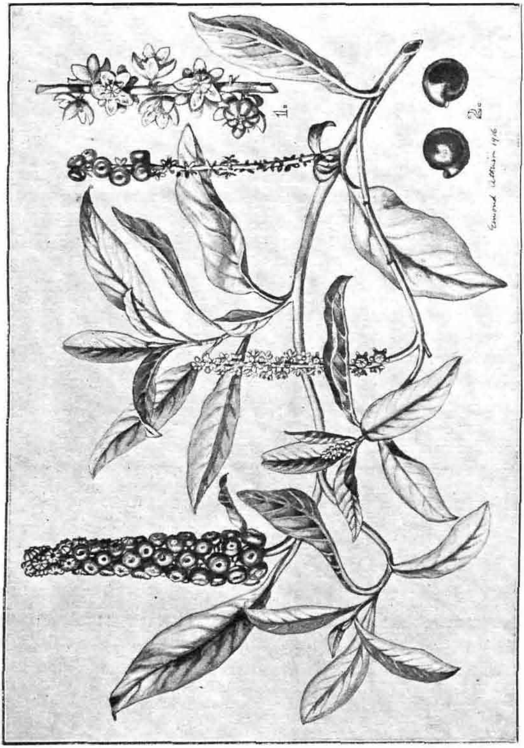
brownish, ⅛ in. long, irregularly top-shaped, with an angled inner face and a convex outer one, and with a hard and rough surface.

Distribution, &c.—Viper's bugloss (which is included in the Third Schedule of the Noxious Weeds Act) is widely distributed throughout New Zealand, though it may be almost absent from large areas. The Province of Marlborough is at present its chief stronghold, and it has there been declared a noxious weed. It is in that district very abundant as a weed of roadsides, dry river-beds, and similar waste places. Its importance to the farmer, however, lies in its being an aggressive weed of pastures, particularly where the soil is loose and dry. Owing to the harsh and bristly character of the leaves and stems, stock will not touch the plant, and where it has obtained a hold it will soon crowd out large areas of valuable grass. Where this takes place ploughing and cultivation should be resorted to. At most times of the year viper's bugloss possesses the power of growing from the root after the crown has been cut off below the surface, but during or just before the flowering season this treatment will kill it. Where only small quantities of the weed are present hand-pulling is the most effective way of getting rid of it. If it is troublesome on cultivated land, summer fallowing combined with the liberal use of the scarifier should be adopted as a means of control. The seeds, though not common as impurities, are occasionally found in those of certain clovers.

The writer is indebted to Mr. A. Hughes, Fields Inspector, Rangiora, for some of the information contained in the above account, particularly that dealing with the methods for the control of the weed.

INKWEED (PHYTOLACCA OCTANDRA).

General Description.—This plant, which is also known as pokeweed and red-ink plant, belongs to a small and little-known tropical family which is chiefly American in distribution. Inkweed is a soft-wooded shrubby plant, forming bushes 4 ft. or 5 ft. high and about the same in diameter. The branches, which are brittle, bear numerous leaves 3 in. or 4 in. long by 1 in. or more in width. The flowers from their small size and greenish colour are inconspicuous, and are arranged in upright tapering spikes which arise singly from the leaf-axils. An individual flower is of simple structure: the petals are absent, but there are five sepals, in the centre of which is an eight-lobed ovary surrounded by a ring of eight stamens which are arranged alternately with the cells of the ovary. After fertilization has taken place the ovary enlarges enormously, gradually losing its octagonal shape until, when fully ripe, it forms a berry-like fruit deep purple or almost black in colour, and in shape



INKWEED (PHYTOLACCA OCTANDRA) FLOWERING AND FRUITING BRANCH. HALF NATURAL SIZE.

1. Part of flower-spike. 2. Seeds, enlarged.

round when seen from above, but much flattened at top and bottom. The fruit is filled with a rich reddish-purple juice, which has been used for ink, and which has consequently given the plant its popular names. The fruit-spike is much more striking than the dull-coloured flowers, and it hardly becomes less conspicuous when the falling of the fruits reveals the persistent calyx-lobes, which have by this time become bright red in colour. The seeds, of which there are eight in each fruit (each seed corresponding to a cell of the ovary), are about $\frac{1}{10}$ in. in diameter, round in outline but with a projection on one side, roughly lense-shaped, and with a brilliant, shining black surface.

Distribution, &c.—Inkweed is very abundant from the King-country northwards, and though it has spread as far south as Wanganui, it is in the north that it attains the greatest prominence. It is one of the most conspicuous weeds of the Auckland Province, on account of its large size and handsome appearance. For many years it has been classed as a weed merely of waste ground or, at most, of ground that could only be partly utilized; but of late its presence on new bush burns has become more and more pronounced, especially in the King-country and in the districts north of Auckland. The rapid appearance of inkweed in new bush-burn country has led many farmers to the conclusion that the seed must have been introduced on to the land in the grass-seed mixtures used. There is no reason whatever to show that this is the case; on the other hand, there is abundant evidence that birds are the agents responsible for the introduction of the plant into new areas. The juicy fruits of inkweed are very attractive to many kinds of birds, and the seeds, with their hard and shining covering, are not prevented from germinating by their passage through the alimentary canal. On bush burns where inkweed makes its appearance in the first season, heavy stocking with young cattle is to be recommended, as such treatment tends to crush out the plant before it attains too great a height to be trodden down.

Although inkweed is recognized as possessing poisonous properties,* there is little likelihood of its proving dangerous to stock, which are not known to touch the plant.

* See article on this subject in the *Journal* for October, 1913, page 369.

Sixteen selections of Scotch vetches were grown at Moumahaki Experimental Farm during the past season. One of the selections gave outstanding results, the seed being evenly coloured and larger than the usual market sample, giving approximately two thousand seeds to the pound. It is intended to propagate this selection during the ensuing season.

FACIAL ECZEMA IN SHEEP.

A NUMBER of inquiries have been received lately regarding facial eczema in sheep, which has been fairly prevalent this autumn in the Poverty Bay and East Cape districts, cases having also been reported from North Auckland. The disease and its treatment was described by Dr. J. A. Gilruth, then Chief Veterinarian, in the 1908 Annual Report of the Department. The subject was further investigated and dealt with by Dr. C. J. Reakes, Director of the Live-stock Division, and Dr. H. A. Reid, Officer in Charge of the Wallaceville Veterinary Laboratory, in the 1910 Annual Report—following an outbreak which was distinctly more extensive than this year's trouble.

A statement regarding the disease made by Dr. Reakes on a recent visit of inspection to the Poverty Bay district in connection with the latest outbreak, is reproduced for general information, as follows:—

In the investigation-work carried out by the Department with regard to facial eczema of sheep special attention has naturally been paid to the point of determining the actual causative agent. Repeated experiments have entirely failed to show that the trouble is in any degree infectious. Healthy sheep shut up in a small loose-box for days together with affected ones have remained perfectly healthy, even though some had the skin of the face scarified in order to provide greater facility for direct infection.

The so-called nasal bot is looked upon with suspicion in some quarters, but it has nothing to do with facial eczema. This parasite is widely distributed among sheep in the North Island, and if it caused facial eczema sheepowners would have a bad time. Our experience of the nasal bot is that it is only very rarely that it even causes any discomfort to sheep harbouring it, and our knowledge of its wide distribution is only gained by the examination of the heads of perfectly healthy sheep after the animals have been slaughtered.

Facial eczema is undoubtedly due entirely to dietetic causes, and the flush of autumn feed is responsible for its appearance this year. Had this feed come away earlier—say, in February—far more trouble would have been experienced, and losses similar to those of a few years back would have recurred. But it may be expected that the advent of the frosts and the consequent check to the growth of herbage will have a good effect in preventing much further trouble.

The result of all our investigations and observations may be summed up as follows: Sheep do not digest and assimilate quick-growing rank

autumn feed well, especially when, as is common with sheep which have been done well, their livers are in a fatty condition, and more or less fermentation of the imperfectly digested food takes place in the digestive tract, with the result that gases are formed and absorbed into the system. These act as a sort of slow poison, causing, to use a common expression, "the blood to get out of order," and producing depression, and also an inflammatory condition of the skin of the ears and face, which is accompanied by intense irritation. The unfortunate sheep in its endeavour to allay this irritation butts its head against stumps, posts, &c., scratches at it with its hind feet, and soon breaks the skin, enabling dirt with its accompanying casual germs to get into the skin-abrasions, and sets up further trouble. The eyes often are also involved in this.

Sheep taken in the earlier stages, properly treated and promptly changed into more suitable pasture, will usually quickly recover. The best treatment is to change to short sweet pasture (when it can be got, but a change, anyway), and the application of a 5-per-cent. solution of Jeyes fluid, Kerol, Izal, or some other coal-tar product of a similar nature to the skin of the face and ears. The administration internally of 4 oz. of Epsom salts is also very valuable when it can be done. The coal-tar application does good by allaying the irritation.

But the great thing is prevention, and on going over some of the rich lush paddocks near Gisborne it is clear to me that prevention there is a difficult matter when all the paddocks on a farm are alike in the abundance of feed—just the thing for cattle-grazing, but not the thing for sheep. Facial eczema is never heard of in country where feed is shorter and the climate colder, conditions which are natural and healthful for sheep. Poverty Bay sheepowners should realize that this is the crux of the whole position. They have rich land, a warm climate, and year by year, whenever a flush of autumn feed comes along, facial eczema is likely to be troublesome, and they should be on the alert to do whatever is possible by adjusting feeding-conditions to the best advantage, under existing circumstances in each place, to do whatever they can to prevent its onset.

Commercial necessities do not always fit in with the natural requirements of sheep, and farmers rightly want to make the best returns possible from their flocks. To do this they must risk trouble like facial eczema occurring from time to time, but, having a knowledge of its nature and its cause, they should do the best they can, compatible with commercial requirements, so as to prevent it.

In connection with the local outbreak excellent work has been done by Messrs. Collins and Broom, Veterinarians of the Department, and Mr. Hingston, Inspector of Stock at Gisborne.

It should be noted that, as anticipated in the above remarks, the trouble has quickly subsided in the Gisborne district.

Unqualified Veterinary Surgeon.—At Oamaru, on 19th April, T. Gordon Lennox, charged with illegal use of the letters "C.V.S.L.," was convicted and fined £10, with 7s. costs.

CIRCULAR WHITE PATCH IN TOMATOES.

In the March issue of the *Journal* (page 200) a description and illustration were given of a somewhat common affection of tomatoes designated "circular white patch." Weather-conditions, and especially excessive sun-heat, were the reasons given for the appearance of this trouble, and correspondence was invited from any growers who had had any experience of the disorder. In response several letters have been received containing useful corroborative observations on this subject.

Mr. H. J. Fowler, of Marton, states that he is of opinion that the trouble is due solely to the scorching effects of the sun, because it is always seen on the sunny side of the rows and upon the same side of the fruit; also because the affected fruits on trained plants are generally upon the lowest trusses, which are subjected not only to the direct rays but also more especially to reflected heat from the ground. When the affection occurs higher up it was noted that the damage was probably originated by the separation in such fruit of the pulp and seeds from the casing, leaving a hollow, and thus preventing the inner part from exerting its cooling effects on the outer.

Mr. L. Shearman, Christchurch, writes that he is perfectly sure the affection is sun-scald, because the patches are always on the upper surfaces facing the sun—never underneath or on the shady side of the rows. After a glaring hot day, and after the plants have been severely pruned, affected fruits were found along the exposed sides of pathways and along the eaves of the houses close to the glass. As a preventive he lightly sprayed the roof with whitewash, after which there was no further damage. When tender fruits were exposed to the full glare of the sun by picking and by the removal of the previously sheltering leaves, the injury in question was observed.

Mr. Christie, Burnside, has come to the conclusion that the affection is caused entirely by excessive heat. He has witnessed similar appearances upon apples and potatoes exposed to the sun.

Mr. W. J. Best, Auckland, says that he concludes the trouble is sunburn. He took healthy green fruits from different plants, exposed them to the sun in January, and produced the same effect.—*R. Waters, Biological Assistant.*

POULTRY-FEEDING WITHOUT WHEAT.

FINAL RESULTS OF THE MILTON EXPERIMENT.

THE feeding experiment which has been conducted at the Department's poultry-station at Milton during the past twelve months for testing the effect, as regards egg-production, of eliminating wheat from the ration (substituting oats and chaffed lucerne) concluded on the 28th April.

Tabulated below are the results of the last period of record (sixteen weeks), and those for the complete year of fifty-two weeks. It will be noted that during the twelve months the wheat-fed birds laid a total of 2,901 eggs, as compared with 2,882 from the no-wheat pens — a difference of 19 eggs, value about 1s. 11d. The cost of production and gross profit are also in favour of the wheat-fed birds, by 4s. 4d. and 6s. 3d. respectively.

The experiment will be reviewed in next month's *Journal* by Mr. F. C. Brown, Chief Poultry Instructor.

FEEDING EXPERIMENT AT MILTON POULTRY-STATION.—RESULTS FOR FOURTH PERIOD (SIXTEEN WEEKS, ENDED 28TH APRIL, 1916).

Record of Eggs laid.

Week ended	Birds fed with Wheat.		Birds fed without Wheat.	
	White Leghorns. (Pen No. 1.)	Brown Leghorns. (Pen No. 2.)	White Leghorns. (Pen No. 3.)	Brown Leghorns. (Pen No. 4.)
1916.				
Jan. 14 ..	22	34	27	35
,, 21 ..	27	33	22	36
,, 28 ..	31	35	30	3[illegible]
Feb. 4 ..	27	34	24	32
,, 11 ..	24	32	23	32
,, 18 ..	26	33	28	36
,, 25 ..	28	33	30	33
Mar. 3 ..	27	32	24	29
,, 10 ..	27	32	25	31
,, 17 ..	21	26	26	31
,, 24 ..	16	32	12	24
,, 31 ..	15	30	13	23
April 7 ..	13	24	14	22
,, 14 ..	10	25	12	18
,, 21 ..	10	18	12	19
,, 28 ..	11	13	8	15
Totals ..	335	461	330	454
Previously laid	1,103	1,002	1,103	995
Grand totals..	1,438	1,463	1,433	1,449

Number and Fair Market Value of Eggs laid.

Pens.	Eggs laid.	Value at 1s. 9d. per Dozen.	Average Eggs per Bird.	Average Value per Bird, at 1s. 9d per Dozen.
		£ s. d.		s. d.
No. 1 ..	335	2 8 10·25	55·83	8 1·7
No. 2 ..	461	3 7 2·75	76·83	11 2·45
No. 3 ..	330	2 8 1·5	55	8 0·25
No. 4 ..	454	3 6 2·5	75·6	11 0·41

Particulars of Foods used.

Food.	Pens 1 and 2.			Food.	Pens 3 and 4.		
	Average Price.	Quantity.	Cost.		Average Price.	Quantity.	Cost.
	£ s. d.	lb.	s. d.		£ s. d.	lb.	s. d.
Pollard ..	8 5 0 ton	67	5 6·33	Pollard ..	8 5 0 ton	62	5 1·38
Bran ..	5 0 0 ,,	20	1 0	Bran ..	5 0 0 ,,	18	0 10·8
Maize ..	0 5 4 bush.	20	1 10·85	Maize ..	0 5 4 bush.	20	1 10·85
Meatmeal ..	0 14 0 cwt.	19	2 4·5	Meatmeal ..	0 14 0 cwt.	19	2 4·5
Wheat ..	0 5 4 bush.	99	8 9·6	Oats ..	0 2 11 bush.	112	8 2
				Lucerne ..	8 0 0 ton	49	3 11·04
		225	19 7·28			280	22 4·57

Comparative Summary.

Pens.	Value of Eggs laid.	Cost of Production.	Gross Profit.
	£ s. d.	£ s. d.	£ s. d.
Nos. 1 and 2	5 16 1	0 19 7·28	4 16 5·72
Nos. 3 and 4	5 14 4	1 2 4·57	4 11 11·43
Differences ..	0 1 9	0 2 9·29	0 4 6·29

Results for Fifty-two Weeks ending 28th April, 1916.

Period ended	Pens.	Value of Eggs laid.		Cost of Production.		Gross Profit.	
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1915.							
July 23 ..	1 & 2	4 9 11·8		1 5 4·5		3 4 7·3	
Oct. 15 ..	1 & 2	4 3 2·75		1 0 10·07		3 2 4·68	
1916.							
Jan. 7 ..	1 & 2	3 9 8·49		1 1 6·07		2 8 2·42	
April 28 ..	1 & 2	5 16 1		0 19 7·28		4 16 5·72	
			17 19 0·04		4 7 3·92		13 11 8·12
1915.							
July 23 ..	3 & 4	4 12 6·9		1 4 2·25		3 8 4·65	
Oct. 15 ..	3 & 4	3 16 10·5		1 1 2·65		2 15 7·85	
1916.							
Jan. 7 ..	3 & 4	3 13 3·66		1 3 10·58		2 9 5·08	
April 28* ..	3 & 4	5 14 4		1 2 4·57		4 11 11·43	
			17 17 1·06		4 11 8·05		13 5 5·01
Differences..	..		0 1 10·98		0 4 4·13		0 6 3·11

* This period is sixteen weeks, as compared with twelve weeks for each of the three earlier periods.

SCIENTIFIC MANURING.

As a sample of the reward which may be the portion of the farmer who will manure scientifically, or at least with scientific guidance, the following letter concerning a soil which is well supplied with lime is quoted :—

I have the greatest pleasure in informing you that the treatment recommended was entirely successful, being beneficial alike to the soil and myself. The result was a bumper crop of oats on a paddock which we are told by some old settlers was never known to have a good crop before. We are absolutely satisfied that the manure you advised was the manure the ground and crop was in particular need of. We fully expect 3 tons of chaff to the acre, while many people think it will thresh out 80 bushels per acre. You will understand it was a really great crop, quite the talk of the district, while a good many of the oat crops around here were a failure this season. The swedes sown with the fertilizer you recommended turned out a very good crop, being a good deal ahead of crops which got a more liberal treatment of manure than ours did. The mangels (the potash recommended being omitted) also turned out a good crop on the whole.

It only remains to be said that the three formulæ recommended for the oats, turnips, and mangels were carefully considered, and only decided upon after the carefully filled-in form of the farmer, the soil of the district, the climate, and all the facts of the case had been examined. It is by such a system that the right fertilizers may be allocated to lands suitable for them, waste being thus avoided. Every pound of fertilizer is made to do its proper share of work, and the duty of helping to feed the Empire in its hour of need—the greatest of New Zealand's duties—is accomplished. — *B. C. Aston, Chemist to the Department.*

PROPOSED FORESTRY ASSOCIATION.

A MOVEMENT has been initiated for the formation in the Dominion of an association to promote afforestation, on the lines of the Royal Scottish Arboricultural Society. In a circular advocating the movement, which has been widely quoted in the public Press, Sir James G. Wilson asks those who are prepared to join such an association, and pay, say, £1 a year as subscription, to send their names, together with a remittance of that sum, to Mr. E. C. Jack, Secretary, Farmers' Union, Box 715, Wellington. The *Journal* wishes the movement every success.

WORK FOR THE COMING MONTH.

NEW ZEALAND is a country of wide variation in climatic and soil conditions. In applying suggested procedure it is, therefore, necessary for the farmer to amend it to suit local weather-conditions and the requirements of his soil—information which can best be ascertained by a study of these problems on the part of the farmer himself. Nothing can take the place of local knowledge. Little advice on an agricultural subject is capable of general application in its entirety.

THE FARM.

FIELD-WORK.

DURING the past few weeks, from date of writing, favourable conditions for field-work have been experienced in most parts of the Dominion. Autumn crops should have been sown with everything in their favour for rapid germination and vigorous growth. Continuance of mild growing weather may be a temptation to some to push on cultivation for further sowings. Except in northern districts, however, there is no advantage and, on the other hand, considerable risk in putting in crops after the passing of May. Considerable breadths of both wheat and oats are, of course, sown in June, even in the South. As to whether it is judicious to do so in any particular case local experience must be the guide. But on cold clay soils, at any rate, seed confided to the ground at the onset of winter is apt to rot, and if it does germinate it frequently fails to root properly, and the growth is feeble.

If the land is in fit condition and it is decided to chance sowing, rye-corn is probably the best cereal to use for a crop. It is hardy, and if it gets a fair chance it will shoot away in spring and overtake the other cereals sown some weeks earlier. One bushel per acre of good rye-corn sown earlier on a good seed-bed makes ample cover, but heavy perishing of seeds must be allowed for in late sowings, and in few cases will 2 bushels prove too thick a sowing in the beginning of June.

Farmers intending to put down lucerne next season should start preparations now by selecting the land and preparing it for a catch-crop to be turned under as green manure in the early part of the season.

The field-work proper to the month, whenever field-work is possible, is the ploughing of old lea to be green-cropped in spring and summer. Be ready to start right in whenever the land is in good ploughing-order. If there is rough feed in the paddock crowd on the stock for a week, and then get the plough going. But every experienced farmer who is honest with himself knows that any grazing he may secure in June or July is a trifle to what he will lose by not having the land mellowed and conditioned by weathering in the furrow through the winter.

If the soil is light and the rainfall heavy, later ploughing is to be preferred, as the turf prevents a considerable amount of washing-out of soluble plant-food during winter, while it decomposes with sufficient rapidity under these conditions to render late ploughing practicable and yet provide good subsequent tilth. The heavier types of land are always more difficult to handle. They must be worked neither too dry nor so wet that the water spews out of the furrow as it is turned. Ploughing land in the latter condition is simply ruinous to the texture of the soil. Choose, therefore, the best time for ploughing, and to enable this to be done start at the first available opportunity. The kind of ploughing advisable will depend on circumstances. Very old tough lea should be skimmed with a wide flat furrow. Otherwise a narrower and deeper furrow set well up to the action of frost is better.

Before these notes appear the land in many districts will probably be surcharged with water. If the hint given in last month's issue regarding clearing away growths and debris from ditches has been taken the water will get away rapidly, and no harm will result. Careful note should be taken now of places where water collects on ploughed land, and an effort made to drain it off before the soil becomes thoroughly soured. Some lime scattered over the place after the water has been drawn off will react with the soil and enable it the better to work to a tilth in spring.

TREATMENT OF PASTURES.

Pastures should have been well harrowed before this, and may be gone over again if the droppings have not been well spread. The best cannot be got out of pastures without this very necessary operation regularly performed. Pastures should also be limed. A very small application of lime now—even as low as 5 cwt. per acre—if followed by an application of superphosphate in early spring will give surprising results. If winter manuring is practised, ground rock phosphate, Ephos phosphate, or any phosphatic guano

should be used in preference to superphosphate and in the absence of basic slag. But even with these the addition of a few hundredweights of lime tells. The lime may be mixed and sown with them

HARVESTING MANGELS.

The lifting of mangel crops should now be undertaken as soon as possible. The practice of feeding off mangels still obtains to a considerable extent, although it has been found a very risky proceeding, and mortality among stock thus fed has been frequently reported. Apart from the risk, there is a large amount of waste in feeding mangels in this way. Growing mangels contain appreciable amounts of nitrates and oxalates, which have a scouring tendency when fed to stock. This characteristic disappears after ripening in storage. The roots also become more nutritive, organic compounds, such as pectin and pectose, becoming changed into sugar, and amides into albuminoids. This process of conversion requires some time—at least two months—before it is fully completed.

In harvesting, the leaves are twisted off by hand, or, if cut, the cutting should not be done close to the crown. The leaves, although occasionally fed to cows, are of little feeding-value and are better left on the ground to plough under and restore humus. Care should be taken not to injure the roots in removing adhering soil, as the mangel "bleeds" freely from a damaged surface. It is better to carry a little soil with them than to injure the root in removing it. The roots can be most expeditiously taken up by two workers each taking two drills and placing the roots, as they are lifted, in the middle space between the four rows. There will thus be a space of four drills between each pile of roots, down which a dray can pass easily when the roots are carted to the site of the proposed pit or clamp.

The mangels are best built up on an 8 ft. base to an apex, which will be about 7 ft. high, the pit thus presenting a triangular section. A covering of dry straw should be provided as a protection against frost, but the pit should be left uncovered along the ridge for a fortnight or so while the preliminary sweating is taking place. There is, in fact, more risk from fermentation in covering over the top at all than from frost when left uncovered. As a further protection in frosty localities, soil may be placed over the straw, being dug out from around the pit, thus at the same time providing for drainage. The soil should be put on to a depth of 8 in. at the base of the pit, but easing off the thickness of the soil blanket until there is only an inch or two near the top, the ridge itself being left uncovered for ventilation.

FEEDING OFF ROOTS.—CLUB-ROOT.

Considerable breadths of turnips have been already cleared off by lambs, but the larger part of this crop and the great bulk of the swede crop have yet to be consumed. Before stocking either of the crops, a careful examination should be made, in order to discover whether any small patches of club-root are present. If such is the case the diseased roots should be netted off and a heavy dose—at the rate of, say, 3 tons per acre—of quicklime dressed over the patches. Only thus can this insidious disease be prevented from becoming general on the farm.

In feeding off roots the main points are to feed in comparatively small breaks, and not to feed too close to the ground before grubbing up the shells. The breaks should be of sufficient size to maintain the mob from ten days to a fortnight. Grown sheep which have also a run of pasture will consume ½ ton to 1 ton of roots per 100 head per day according to grazing available. Any old ewes still on hand may be made to turn an extra profit by giving them first run over the tops.

It seems likely that a considerable part of the turnip and swede crops will, owing to the high price of stores for fattening, be used up by ewe flocks. Turnip stocking with ewes should as far as possible be delayed while the grass is fair. When ewes are started on turnips care must be taken that they are moved about periodically. They should be taken off every afternoon and returned next day only after the frost has lifted. A few hours per day on the turnips is all that is necessary to keep ewes in good thrifty condition. If restricted to this amount of feeding and regularly moved about there will not be much risk of paralysis or protrusion of the vagina.

Rock salt and an allowance of good hay are essential for ewes on roots. The hay may be supplied on the pasture when the stock is run off the root break. In moving in-lamb ewes about no driving or harassing should be allowed. Regularity and quiet handling will make matters much easier at lambing-time.

CRUTCHING OF SHEEP.

Reference was made last month to the desirability of crutching. There are good reasons to support this practice. Especially on better-class land failure to crutch results in an exceedingly dirty condition or necessitates frequent dagging. If crutched early the crutchings help to pay for the work, but dagging is out-of-pocket expense entirely. In crutching, however, there is no need to half-shear the hind quarters, and the ewes require to be handled in a way considerate of their pregnant condition.

REPAIRING OF COW-SHEDS.

Now that the cows are dry for the most part, some attention can be given to cow-sheds. Where it is intended to put down concrete—and this is always advisable—the work should be done at once, so as to give the concrete a chance to get thoroughly dry before the new season begins. If the floor of the shed is made thoroughly firm, 4 in. of concrete will be found sufficient, and this should be made of 4 parts clean shingle, 1 part sand, and 1 part cement. If the surface is finished off with a wooden trowel the cows will not slip. Gutters should have rounded edges, and should not be more than 4 in. deep. Where gutters are deep and square, injuries from slipping are apt to occur and manure gets splashed about.

THE ORCHARD.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

THE dormant season's work in the orchard becomes general from the month of June, and the fullest advantage should be taken of the opportunity thus afforded to do a general cleaning-up and the hundred-and-one small and large jobs that can only be satisfactorily attended to during this period. The largest of these will of course include pruning, the several forms of winter spraying, cultivation, and planting.

SPRAYING.

Autumn spraying in regard to die-back of the peach, San Jose scale, and woolly aphis was fairly fully dealt with in last month's notes, a summary of the recommendations being as follows:—

Die-back of peach—8-6-40 Bordeaux mixture, as soon as possible after the foliage has fallen. Die-back of peach and San Jose scale—lime-sulphur in the ratio of 1–15, as soon as possible after the foliage has fallen.

Woolly aphis—emulsified oil, 1–25, as soon as the foliage has fallen sufficiently to allow of the work being properly carried out.

The above remedies were recommended for early spraying, but in most cases where not applied before this the following is recommended.

Stone-fruits.—For fungus diseases spray with sulphate-of-copper solution in the ratio of 1 of sulphate of copper (bluestone) to 15 of water.

For red mite and San Jose scale, spray with oil emulsion in the ratio of 1 in 17, if possible within twenty-four hours of spraying with sulphate of copper.

Pip-fruits.—The spraying of pip-fruits had now be better left until the end of July or the beginning of August, when the following should be applied: Sulphate-of-copper solution, 1 in 10, for the destruction of fungus spores, followed immediately with oil emulsion, 1 in 12, for San Jose and mussel scale, mealy bug, red mite, and woolly aphis.

PRUNING.

Pruning of both the non-bearing and bearing tree is a matter of the greatest importance to the future welfare of the tree. In the case of the young tree the principal object is to build up a strong sturdy tree with a well-spaced framework. This can only be accomplished by careful and systematic pruning year by year. If such be done the work is comparatively easy so long as other matters in regard to the health of the tree are attended to; but when a tree is left more or less to grow as it pleases when young, the matter of subsequent shaping is almost sure to present many difficulties, and often such difficulties are insurmountable.

In respect to bearing-trees pruning is of equal importance. Each class and each variety more or less requires special treatment in regard to detail, but apart from this the general principle applies and is worthy of far wider attention than it receives. Generally speaking, throughout the fruitgrowing districts of New Zealand the trees bear readily enough. The trouble with many varieties is that they bear too readily. Peaches, particularly throughout the North Island, even on carefully pruned trees, will set and carry far more fruit, if not thinned, than is good for either the fruit or the tree. In cases where such trees are left unpruned or lightly pruned, and the fruit is not thinned, the fruit is very soon played out, for no tree suffers so quickly as the peach from overbearing, particularly when accompanied by other adverse conditions, such as bad cultivation or drought. To avoid this condition as far as the pruning is concerned it is necessary to cut back almost half of the fruiting-wood, both to provide fruiting-wood for the following season and to maintain healthy vegetation throughout the tree, and for the latter reason also the leading growths should be cut back reasonably hard.

There are also many varieties of apples which, left to themselves, become stunted and dwarfed in a few seasons. The habit of many of the varieties of apples now grown is to bear heavily when young. This, combined with little or no pruning, has the

disastrous effect on the tree which is to be seen more or less in every fruitgrowing district in the Dominion. Pruning combined with thinning, according to the age and vitality of the tree, will to a large extent prevent this habit, and will also greatly assist in remedying any existing evil of the kind, if not of too long standing. But a tree thoroughly stunted through the lack of pruning, overbearing, and such causes is often very slow to answer to the more growth-encouraging treatment, and in many cases nothing short of heading back will have the desired result. The aim, however, should be to prevent a condition of this kind by not allowing the varieties in question to bear too heavily until a tree of a satisfactory size has been raised, and to bring this about fairly heavy winter pruning of such varieties should be maintained.

PLANTING.

If the land is thoroughly worked and is not too wet, June is an excellent month for fruit-tree planting. Before planting all the young trees should be dipped in a solution of 1 in 15 oil emulsion for the destruction of insects pests and their eggs. This should be done despite the fact that the nurseryman may have already sprayed the trees, as it is better to be sure than sorry. A double dose will not hurt the trees, and the process is not laborious or expensive.

THE POULTRY-RUN.

F. C. BROWN, Chief Poultry Instructor.

ALTHOUGH June may be a comparatively slack month as regards the poultryman's work, this condition should not apply to the birds themselves. There should now be no culls in the yards. Every hen should either be laying or be due to lay within the next two months. The diet should therefore be liberal and of a forcing character. Everything, in fact, should be done to encourage egg-production. All pullets should be laying by now, while the attention the second-season bird now receives will largely influence the time at which she will again come to profit. Especial care should be taken for the comfort of the stock at this period of artificially stimulated production, so that only a minimum amount of the food supplied will be required for the maintenance of the laying-bird's condition. Every assistance should be given her in order that she may attain her maximum yield. An abundant supply of grit, a plentiful supply

of fresh water, a daily ration of green food, and good dust-baths are of great importance. Also keep the nests clean, and periodically renew the nesting-material. Everything, in short, should be done to prevent any check to production.

THE CONFERENCE.

The large number of delegates of the various co-operative bodies and individual members from all parts of the Dominion that attended the annual conference of the New Zealand Poultry Association at Wellington during Easter-time must have been very gratifying to the promoters of the association, as well as to those members that have taken an interest in the latter since its inception some five years ago. The broadening of the constitution, so that for the small sum of 2s. 6d. any person interested in the poultry industry could become a member and a participant in the Conference without the right of voting, and the inclusion of active members by a subscription of 10s. 6d., carrying with it voting-power, has proved a step in the right direction. The Conference was no doubt the best that has yet been held. The businesslike manner in which the proceedings were conducted, and the good feeling that existed throughout, clearly indicate that the association is on a sound foundation. Given the support it deserves, there is every encouragement that the association will be a strong factor in building up the industry.

A feature of the association is that it does not dictate to its affiliated bodies. The various remits, &c., which are brought forward are discussed at the Conference, and according to the results of the voting the question is approved or otherwise. It will therefore be seen that by joining the association no club need sink its individuality. As the object of the association is to encourage and promote the interests of the poultry industry in all its branches, it is somewhat surprising that more of the poultry clubs, as well as individual poultrymen throughout the Dominion, do not give the association their whole-hearted support. A good foundation is laid, but the objects aimed at can only be reached by the united efforts of all poultry-breeders both large and small. The great aim of the association at present is to improve the methods of marketing eggs. It is realized that the industry will never be placed on a sound footing without organization to control the marketing of the egg product, and that the formation of egg circles or similar concerns is the first stepping-stone in this direction. The members of the New Zealand Poultry Association are to be congratulated on the good work they have done, and are endeavouring to do, for the welfare of poultry-keepers generally, whose watchword should be "organization."

THE EGG POSITION.

Considering the excellent climate for poultry-raising that this country enjoys, the increased knowledge now available in regard to poultry-management, the vast improvement that has taken place in the laying type of certain breeds of poultry, and the consequent inducement to people to take up the industry, it is certainly a matter for surprise that New Zealand does not produce sufficient eggs for its own requirements. The present retail price of fresh eggs (in the vicinity of 3s. per dozen) and the fact that thousands of dozens of eggs have been imported into the Dominion in each of recent years clearly indicate that the demand exceeds the supply, and that more than one reform must be effected before the business is placed on a sound footing.

As in the past the principal present-day weakness of the industry is lack of organization among the producers, especially in regard to marketing. Such organization is not necessarily with the object of raising the price of eggs, but rather to bring about a more uniform price throughout the year. The cost of foodstuffs certainly determines to a great extent the profits to be made from poultry-keeping, but, as is the case with all classes of farm-produce, a good system of marketing is an essential factor to success. For eggs to be down to 10d. and 11d. a dozen in the spring and summer months and up three times this value in the winter is proof that reform in the matter of marketing is imperative. These prices also indicate that the demand for eggs over the supply lasts only a short period. The main thing to be desired is the maintenance of a reasonable, payable price throughout the year, even in times of dear feed. This can only be achieved by co-operation, whereby the summer surplus may be preserved for winter by the producers themselves. It is in the spring and summer, when eggs are most plentiful, that the producer should have a higher price than formerly for his eggs.

When eggs are high in price it shows that comparatively few eggs are being produced, and therefore the great bulk of the fowls at the present time are being kept at a dead loss, being fed without giving any return. Many birds will have to be fed right through next spring, and then, when they resume laying, their eggs will have to be marketed at a very low rate which will not allow for more than a small margin of profit. To produce the necessary additional number of eggs required by the Dominion the existing stock of poultry must be increased. A permanent increase, however, cannot be expected until a better system of marketing is brought into force. Until then history may repeat itself—namely,

that when food is cheap the industry will expand, but any advance in food-values will result in a serious reduction of stock.

In the years 1907–8 poultry-keepers were confronted with a similar situation, though not quite so acute as that which they have had to face during the past eighteen months. At that time foodstuffs soared to excessively high prices, with no commensurate advance in the price of eggs, with the result that large numbers of poultry-keepers were forced out of the business. For the two seasons following that crisis foodstuffs became cheaper in price, and eggs and poultry obtained good values. Only when poultrymen unite and are in a position to control and regulate supplies and prices throughout the year can these unstable and fluctuating conditions be altered and the industry make steady advancement and become a sound business proposition.

The first step to co-operation is the formation of egg circles, the next centralization, and then a scheme whereby reliable distributing agents may be appointed, who would not only be prepared to market the eggs, but also to store the summer surplus, and finance producers in order to enable them to cater to the consumer in an up-to-date manner.

THE APIARY.

E. A. EARP, Apiary Instructor.

EXPORT.

THE product of the apiary intended for export must be carefully handled if the maximum number of points are to be obtained. A careful examination at intervals should be carried out to ensure the arrival of the honey at the grading-store in good order. In these days of keen competition packing is an important factor and demands the producer's close attention. The regulations relating to the export of honey are now law, and every producer on a commercial scale should possess a copy. They set forth in a clear manner the requirements for export. For some time past grading has been optional, but now that it is compulsory every effort should be made by the beekeeper to comply with the conditions imposed and thereby secure the maximum number of points allowed. Initial shipments of uniform grade and quality will create a good name for our produce on the Home markets, and if we are to maintain our reputation as producers of high-grade honey reasonable care and attention at the time of packing must play an important part.

It rests with the producer to grade his product prior to shipping to the grading-store, and thus save time and extra cost of handling. In many districts in the Dominion each successive extracting may differ slightly in quality from the previous ones, and each lot of cases should be marked accordingly. It is an easy matter for the beekeeper to note the quality of any number of tins he may run off the tank and furnish the grader in his district with the particulars. Do not forward honey that is not granulated, as the regulations provide against any other honey leaving the country; and, moreover, liquid honey will be stored at the expense of the producer until such time as it can be handled. It may be months before the graded product reaches the buyer, therefore provide good strongly constructed tins free from rust. Carefully oil or lacquer all tins on the outside, having previously removed all traces of honey that may have been spilt on them. Lacquer may be procured from the dealers at a reasonable cost, or, if desired, linseed-oil may be substituted, and it is just as effective to use for the purpose of avoiding rust. Do not smear the outside of the cases with lacquer or oil. Brand the cases neatly on one end only. It is poor policy to use poorly constructed cases, as the honey is subjected to a great deal of rough handling before it reaches its destination, and economy in this direction cannot be too strongly condemned. Good well-seasoned cases will ensure safe shipment. Press the lids on tightly, but on no account use solder, as every tin is opened at the time of grading. Reject all tins of which the caps are not tight-fitting.

TREATMENT OF WAX.

The rendering into commercial wax of old combs and cappings, which may have accumulated owing to pressure of time in the busy season, requires attention. There is less trouble in dealing with wax during the cold months, as the bees will not be flying in numbers, and consequently the work can be carried on without causing undue excitement. Where foul-brood combs have been stored for melting these may be treated without the risk of spreading infection. The rendering of wax is a messy job at all times, more especially if the beekeeper is not possessed of one of the recognized wax-presses in general use. The steam-heated presses usually adopted have simplified matters, and have reduced the work of converting old combs into marketable wax. In every apiary where ten or more colonies are kept a good press will prove a profitable investment.

Out of the number of presses on the market the Hatch is the cheapest, and will perform its work quite as well as any of the

larger ones. In treating combs and cappings with the press named it is necessary to use a boiler in which to melt the wax prior to straining it. An ordinary washing-boiler makes an excellent vessel for the purpose, but, failing this, kerosene-tins may be utilized. A fair proportion of the space in each vessel must be occupied by water in order to prevent the wax from burning. When the water boils the cappings and combs may be added. Frequent stirrings are necessary to expedite the melting of the wax. As soon as the whole mass liquefies it should be ladled off into the scrim bag provided with the wax-press and pressure applied. Do not allow the mass to boil freely, as overboiling injures the consistency of the wax. It should be liquid and no more. The scrim bag will retain practically all the impurities, and the wax and hot water will run away freely, and should be collected in kerosene-tins and allowed to cool. A good idea where there is more water than wax is to pump the water away slowly as it falls by means of an ordinary kerosene-pump. As the wax floats this can easily be done by sinking the pump to the bottom of the vessel. By adopting this method all the wax is collected in one utensil, and the greater proportion of the water is disposed of quickly and easily.

When the wax is cold it should be carefully remelted in clean water, care being taken to keep it under boiling-point. In forming the cake for the second time allow it to cool very slowly. By this means any impurities which remain after its passage through the wax-press will be precipitated to the bottom of the cake. The vessel in which the wax is cooling may be stood in a strong wooden box and insulated by means of cloths or sacks. Keeping the wax liquid for many hours is a better method of purifying it than the use of sulphuric acid. The quantity of acid which it is safe to use is so small that it is only advisable to employ it where large masses of wax are being treated. A vessel of cold water should be kept handy during the whole process of melting, to add if the wax shows any signs of boiling over.

LITERATURE.

With the advent of winter, and practically all outside apiary-work being suspended, the beekeeper may now find time to study. It is surprising how little knowledge commercial beekeepers as a rule possess of the scientific side of their craft, more especially when we take into consideration the number of publications on the subject at their command. When delving into the scientific side the work of the apiary becomes more fascinating, and much of everyday drudgery is forgotten. If beekeepers could be brought to understand the instructiveness of bee literature I am quite sure that few

of them would be without a small library on the subject, and still fewer would neglect to subscribe to current periodicals. Special bee periodicals are published in New Zealand and Australia applicable to local conditions, but the ambitious beekeeper who would like to learn the experiences of older and abler craftsmen will find the American and the Old World journals exceedingly instructive. The value of good works on bee-culture is so great in comparison with their cost that the latter need hardly be taken into consideration.

SUGAR FOR FEEDING.

In view of a probable rise in the price of sugar, beekeepers would be wise to lay in a stock before the end of this month. Beekeepers, especially in the South Island, cannot afford to run the risk of a shortage of sugar at a time when their bees require artificial stores. There is no more important matter in beekeeping than spring feeding, as on it depends largely the success or failure of a future crop.

BEEKEEPERS' CONFERENCE.

A conference of beekeepers will be held in Wellington, commencing on 7th June, when important matters relating to the industry will be discussed. Beekeepers who can spare the time to attend will be well advised to do so, as it is only by meeting and discussing phases of development that a successful future for the industry can be assured.

THE FARM GARDEN.

W. H. TAYLOR, Manager, Arataki Horticultural Station.

VEGETABLE-CULTURE.

No opportunity should be lost to improve the soil. Deep working of the soil is the only way to secure good crops all the year round. During winter deeply worked soil is required to increase warmth by lowering the water-table. In summer-time deeply worked soil holds moisture. At all times it increases the growth of plants by enabling them to make stronger roots. Roots deep down are less affected by adverse weather, whether it be extreme heat or cold, than are those near the surface. Deep trenching renders valuable many substances that would otherwise be wasted. Weeds of every description can be utilized if put deep down. Even dock-roots will rot if put down 2 ft. from the surface. Cabbage-stalks and all garden and house rubbish can be worked in, and will make otherwise poor soil rich. These matters should be seen to while the soil is easy to

work, being moist from rain, as the work is comparatively cheaply done while these conditions prevail.

Asparagus tops should be cut down level with the ground. If planted in lines on the flat—the modern plan—lightly fork the ground over and give a dressing of stable or farmyard manure. Too much manure cannot be given, though excessive dressings are not really necessary. I have been several times asked if it is necessary or right to lay the crowns bare by dragging away the soil, and leave them in that condition through winter. Some growers are known to do this. My belief is that the practice is the result of a mistake caused by confounding two distinct methods of culture. On the Continent of Europe, particularly in France, they prefer white asparagus. The same is required by canning-factories. British people prefer green stems. It is the green stems our method is intended to produce. For the production of white stems the plants are grown in rows usually 4 ft. apart, and the plants not nearer than 3 ft. to each other in the rows. In spring, before growth begins, ridges are thrown up with a plough or other means, so as to cover the plants many inches deep with soil. The heads make their way through the ridge and are cut low down. The result is heads 12 in. or more long that are white up to the top. The ridges are torn down in autumn when the annual cutting-down is done, the soil being left level till fresh ridges are thrown up the next spring. Note that the crowns are not laid bare. It is this method of treating asparagus that leads people who do not understand the matter to say that the French people grow better asparagus than we do. It is just the same, but blanched instead of green.

Winter rhubarb should be encouraged to grow by keeping the soil clean and open. Manure it if required—a thing that is not likely to be overdone, as rhubarb will take as much manure as may be given. These varieties may be planted now or at any time desired, though the best results are obtained by sowing seed early in summer.

Cover *seakale* by boxes surrounded with fermenting manure for forcing. Any one having a heated greenhouse can force the heads beneath the benches. The crowns are to be lifted, placed as close together as possible in large pots or in boxes, and covered effectually to keep them dark. When this plan is adopted the plants are raised annually from whips of the roots, to provide the necessary crowns.

Plant *cauliflower*, *cabbage*, and *lettuce* as soon as the plants from the autumn sowing are strong enough. Be sure to plant two kinds of cauliflower, one early and one a large kind, at the same time, as that is the only way to avoid a break in the supply. This planting is important, because it provides for the spring and early summer supply.

In some districts—Hawke's Bay is one—the best crops of *peas* are from those sown in May. Be sure to sow two kinds at the same time—a dwarf and a medium-tall variety. They will succeed each other. If for any reason it should be decided to sow one kind only, this should not be a true dwarf, as a medium-height variety would give better returns, though a week or two later.

SMALL FRUITS.

Loganberries are best grown on new rods every year. There is seldom any difficulty in securing a sufficiency each season. The old rods should be cut out if there are enough young ones for fruiting. If there are not, some of those that fruited last season may be kept. They will fruit again if the bearing-twigs are reduced to short spurs.

Gooseberries may be pruned as soon as the leaves are off. Remember that there is nothing gained by having a crowded bush, and the latter is a constant nuisance. If the branches are kept open to light they will give their best, and only then. Prune so as to secure a bush that is so open that fruit can be gathered in comfort. Such a bush has as much wood as it can properly furnish with fruit. Cut out branches where necessary. The young growths in the centre should be reduced to spurs, and those on the outside shortened to strong buds. Keep an open centre.

Red and *white currants* should be kept to a single main stem. They should not be allowed to throw up stems from under the ground. Keep a perfectly open centre. All shoots except leaders should be reduced to short spurs. They never bear fruit on young wood. Shorten leaders to about 10 in. *Black currants* should be allowed to stool. Underground shoots provide a means for frequently renewing the bush and an effectual method for defeating the borer. The latter takes time to destroy a branch, which can be replaced by new wood. The black currant bears on the wood made the preceding season as well as the older wood. Advantage should be taken of this habit by leaving young shoots where needed. A hollow centre should not be grown, and the bush need not be kept so open as gooseberries and red currants, but the branches should not be crowded.

THE FLOWER-GARDEN.

Planting of every description can be undertaken, due allowance being made for local conditions. Planting should never be done while the soil is in a sodden state. Unless the soil is in good working-condition the roots of plants will not take to it. There are physical reasons also against planting in wet ground, or, indeed,

working it at all. Planting may include *roses*, which should be planted without pruning if put in before the middle of June. After that time the advantage of autumn planting is lost, and pruning should precede planting.

Herbaceous perennials, such as phlox, rudbeckia, perennial sunflowers, &c., become worn after several years. These should be dug and sufficient taken from the outside of the clumps to plant back. Few things do well without such attention; the clumps get too wide. There are exceptions to this rule. Solomon's seal, dielytra, hoteias, geums, and things of like nature improve instead of deteriorating as they become larger.

All *bulbs* still out of the ground should be got in at once. *Seedlings* in boxes should be pricked off in good time.

Wallflowers that have filled their boxes would be best transferred to the open ground in nurse-beds, to remain there till the ground is ready for them; or plant them in their proper place if convenient.

When digging and manuring the garden, do not dig deeply round such things as azaleas, rhododendrons, kalmias, camellias, or other fine-rooted shrubs. There is not any advantage to be gained in manuring such plants. More likely it will do harm by injuring the flowers.

QUALIFIED VETERINARY SURGEONS.

NEW ZEALAND LIST.

THE following list of qualified veterinary surgeons known to be resident in New Zealand is published for the guidance of stockowners and for general information.

In the event of the name of any properly qualified veterinarian being omitted, it is requested that he communicate with the Editor, giving particulars of his qualification, in order that the necessary steps may be taken for the inclusion of his name in the next published list.

* Ashe, G. G., M.R.C.V.S., Christchurch.
* Barnes, A. W., M.R.C.V.S., Hastings.
* Barry, W. C., M.R.C.V.S., Christchurch.
† Begg, W. P., M.R.C.V.S., Ashburton.
* Blair, W. D., M.R.C.V.S., Dunedin.
*† Blake, T. A., M.R.C.V.S., Wellington.
Brodie, A. M., M.R.C.V.S., Hastings.
* Broom, G., M.R.C.V.S., Gisborne.

* Officers of the Live-stock Division, Department of Agriculture.
† Absent with the New Zealand Expeditionary Forces.

* Burton, S., M.R.C.V.S., Wellington.
* Carbury, H. W., M.R.C.V.S., Wellington.
Cockroft, J. E., M.R.C.V.S., Feilding.
* Collins, W. T., M.R.C.V.S., Hamilton.
Crossley, F., M.R.C.V.S., Wellington.
* Cunningham, T., M.R.C.V.S., Oamaru.
† Danskin, J., M.R.C.V.S., Balclutha.
† Edgar, P. M., M.R.C.V.S., Wanganui.
Elphick, E. E., M.R.C.V.S., D.V.H., Gore.
Glover, F., M.R.C.V.S., Hamilton.
Gomez, C. V., D.V.M. (San Francisco), Waiuku.
Hamilton, A., M.R.C.V.S., Musselburgh, Dunedin.
* Hickman, A. J., M.R.C.V.S., Auckland.
*† Howard, E. C., M.R.C.V.S., Wellington.
Johnson, A. A., F.R.C.V.S., Christchurch.
* *Kerrigan, J., M.R.C.V.S., Christchurch.*
* Kyle, H. S. S., G.M.V.C. (Melbourne), Christchurch.
† Lewis, W. J., M.R.C.V.S., Porirua.
Lilico, T. G., M.R.C.V.S., Christchurch.
* Lyons, J., M.R.C.V.S., Auckland.
† *Machattie, D. H., M.R.C.V.S., Leeston, Canterbury.*
* Marsack, H. L., V.S. (Ontario), Auckland.
Martin, H. E., M.R.C.V.S., Timaru.
* Meade, R. H., M.R.C.V.S., Palmerston North.
Miller, J., M.R.C.V.S., Invercargill.
† Neale, C. R., M.R.C.V.S., Hawera.
* Paterson, A. M., M.R.C.V.S., Timaru.
*† Primmer, J. H., M.R.C.V.S., Palmerston North.
Quinnell, W. C., M.R.C.V.S., Wellington.
† Rait, D. H., M.R.C.V.S., Palmerston North.
* *Reakes, C. J., D.V.Sc., M.R.C.V.S., Wellington.*
*† Reid, H. A., F.R.C.V.S., D.V.H., F.R.S.E., Wellington.
Ring, W. C., V.M.D. (Penn., U.S.A.), Ellerslie.
Robertson, F. C., M.R.C.V.S., Ashburton.
Robertson, F., M.R.C.V.S., Oamaru.
Siddall, E. Lloyd, M.R.C.V.S., Opotiki.
† Simpson, C. S., M.R.C.V.S., Parnell, Auckland.
* Snowball, W. D., M.R.C.V.S., Dunedin.
Spilman, D., M.R.C.V.S., Lower Hutt.
*† Stafford, J., M.R.C.V.S., Christchurch.
‡ Stapley, W., M.D., D.V.Sc., M.R.C.V.S., Cambridge.
† Taylor, A., M.A., M.R.C.V.S., Lincoln, Canterbury.
Taylor, J. B., M.R.C.V.S., Waverley.
*† Taylor, W. G., M.R.C.V.S., Ashburton.
*† Waugh, G. N., M.R.C.V.S., Invercargill.
* Wood, R. B., M.R.C.V.S., Waitara.
*† Young, A. R., M.R.C.V.S., Wellington.

* Officers of the Live-stock Division, Department of Agriculture.
† Absent with the New Zealand Expeditionary Forces.
‡ Not now practising as a veterinary surgeon.

FORTHCOMING AGRICULTURAL SHOWS.

Otago A. and P. Society: Winter Show at Dunedin, 30th May to 2nd June.
Waikato Winter Show Association: Show at Hamilton, 30th May to 3rd June.
Taranaki Metropolitan Agricultural Society: Winter Show at New Plymouth, 7th to 10th June.
Manawatu and West Coast A. and P. Association: Winter Show at Palmerston North, 20th to 23rd June.

ANSWERS TO CORRESPONDENTS.

In every instance a question to which an answer is desired in these columns must be accompanied by the full name and the postal address of the inquirer, not necessarily for publication, but as a guarantee of good faith. The question should be written on one side of the paper only.

ARSENIC AND ARSENITES.

STEPHEN ANTHONY, Coromandel :—

In the *Journal* for January there was given a prescription for a blackberry-killing mixture, the chief ingredient of which was crude arsenic. By "crude arsenic" is the usual arsenious acid meant, or is it something else? Arsenious acid is very little soluble in water, and that was my difficulty when I tried to make up a home-made article.

The Fields Division :—

Crude arsenic is white arsenic, or what is commonly known as "arsenic." It is in reality arsenious *oxide*, and is soluble in water. The various arsenious *acids* (arsenites) are not soluble in water, except the arsenites of the alkali metals, which are soluble in water. If you ask for white arsenic (arsenious oxide) you will be doing the right thing.

MILK-FEVER.

C. G. REYLAND, Matakohe :—

Can a cow get milk-fever by being milked too dry shortly after calving, or is she liable to have the fever by a calf sucking one quarter dry and leaving the others untouched?

The Live-stock Division :—

It is not advisable to milk a cow too soon after calving. A fleshy, plethoric cow, or one which has been affected at a previous calving, should not be milked for at least twelve hours. Breeders in the Channel Islands do not milk their cows for twelve to twenty-four hours after calving, and by so doing have almost abolished the mortality from milk-fever. It is very seldom that a cow suffers from this complaint when the only means of drawing off the milk is by the calf. The mere fact of the calf sucking one teat would not produce the disease.

HOME-CURING BACON AND HAMS.

T. THORNE SECCOMBE, Te Teko :—

Would you please furnish me with a reliable recipe for the soft curing of bacon and hams. I would like the bacon to be cured soft, not as hard as a board, as one generally sees home-cured bacon.

The Live-stock Division :—

The cause of hardness in bacon referred to is due to the excessive use of saltpetre, especially through using it during the first stages of curing. For home curing a suitable recipe is as follows: Weigh out for each 100 lb. meat 5 lb. salt, 2 lb. brown sugar, and 2 oz. saltpetre. When the carcase is thoroughly set cut up and salt lightly, then lay it overnight upon a clean concrete floor or table. By

salting lightly is meant that as much salt as will cover the meat comfortably without undue waste be used. Next morning brush the salt off thoroughly, then dry-salt the meat with dry salt and brown sugar, rubbed well in daily for three days. On the fourth and fifth days a little saltpetre should be added to the salt and sugar, which should be well rubbed in, especially on the skin. Leave the bacon and hams in the mixture (dry salt and brown sugar) for about three weeks, but they should be turned every day or second day; at the same time continue rubbing during this period. Then wash clean, when the bacon and hams will be ready for smoking, the duration of which depends upon the taste of the manufacturer. After the first week or ten days it is advisable to brush the salt and sugar off the inner side of the thin parts of the bacon (flaps). Note that dry salting should only be undertaken in cold weather and in a cool place.

SMALL BIRDS AND GRASS-SEED.—EXPLOSIVES AND GORSE.

C. N., Pahautanui:—

1. Which is the best way to protect grass-seed from the small-bird nuisance when sown?

2. I am the possessor of a farm with patches of heavy gorse. Would it be possible to utilize dynamite or other explosive to destroy it and to cultivate the ground at the same time?

The Fields Division:—

1. There is no feasible way to protect grass-seed from small birds when sown—under field conditions. The only thing to do is to lay poison.

2. The use of explosives for clearing heavy gorse and cultivating the ground at the same time would not be feasible. There is only one way to destroy gorse—by burning and grubbing out, or by ploughing when the young gorse is too thick to grub. Explosives are expensive, and they cannot take the place of implements for cultivating purposes and gorse-eradication.

TANKS FOR SKIM-MILK.

"SUBSCRIBER," Feilding:—

I have made two concrete tanks for holding skim-milk, and I find that the acid in the sour milk takes off the plaster inside the tanks, and that it allows them to leak a little. Can you inform me of anything that I can put into the cement or plaster to prevent it crumbling away?

The Dairy Division:—

Concrete is quite unsuitable for the holding of skim-milk or whey. Many of such tanks have been erected for this purpose in years gone by, but their use has to be discontinued on account of the concrete being affected by the action of the acidity in the liquid. We have no knowledge of any material which could be added to the cement plaster to prevent it being affected in the manner described. Tanks made of wood, galvanized iron, or light steel plate are much more suitable for the purpose of holding skim-milk.

SALE OF MEAT.—LAMPAS IN HORSES.

"GEYSER," Rotorua:—

1. Would you kindly tell me whether it is legal for a farmer to retail meat in a town to the extent of three sheep or one beast per week?

2. Also, is searing for lampas in horses allowed by law?

The Live-stock Division:—

1. It is illegal for a farmer to sell either beef or mutton anywhere inside a borough or town district, or within three miles of the nearest boundary thereof, unless such meat was slaughtered in a registered abattoir or licensed slaughter-house.

2. The practice of burning or searing out lampas in horses is illegal, inasmuch as, apart from giving the animal unnecessary suffering, it deprives him of that portion of the palate which helps to keep the food in the mouth. The majority of horse-owners in the Dominion have quite a mistaken idea in regard to lampas, and consider that should the palate protrude below the teeth the horse is suffering from the complaint. This is not so. The malady is observed to be an inflammation of the mucous membrane of the fore palate, brought about through teething or through some digestive trouble which can be remedied by dieting. As long as a horse has grass he is not likely to have lampas.

PLUM-RUST.

"SUBSCRIBER," Brown's :—

Could you let me know the cause of the leaves falling off plum-trees before the fruit is ripe, and what could be done to prevent the trouble? Would a dressing of lime do any good applied to the ground?

The Horticulture Division :—

The trees are no doubt affected with plum-rust. This disease causes considerable damage to stone-fruits, particularly English plums. Spray the trees when dormant with bluestone solution at the rate of 1 lb. of bluestone to 15 gallons of water. Spray the trees about the time the disease appears in the summer with lime-sulphur, 1 in 125. Repeat if necessary. A dressing of lime may be of value to the soil, but would be of little use in controlling the disease.

CANKER IN HORSE.

"HARPSWOOD," Ohakune :—

I have a heavy draught mare troubled with some skin-parasite about the pasterns and lower part of all four legs. They form a hardish lump, scabby-looking on top. She keeps stamping her feet and biting the sores or rubbing them against logs. She seems more particularly irritated after walking through water. I keep dressing her legs with kerol, and this seems to do her good, but if I neglect her for a few days she seems as bad as ever. She seems to need something more permanent — some ointment that would stay on for some hours, at any rate. Would you advise me, and also tell me whether to cut off the long hair or not?

The Live-stock Division :—

The malady referred to, generally known as "greese" or "canker," is principally met with in draught horses, and is to a certain extent constitutional. The treatment you have adopted—diluted kerol—is good, as, apart from its healing propensities, it also allays the irritation. The following ointment could be used in conjunction and alternately: Vaseline, 1 oz.; zinc oxide, 2 drams; iodized phenol, 20 drops. The hair should be clipped close, so as to expose the affected parts and enable you to keep the latter clean. An occasional dose of 1 oz. of Epsom salts and half a teaspoonful of powdered gentian is beneficial. No over-heating food should be given unless the mare is in constant hard work.

LIMESTONE.

H. RUDDELL, Otaika Valley, Whangarei :—

Is there any simple method of burning limestone, and what method and amount of heat should be used? In this district there are several outcrops of limestone, and I wish to know how to distinguish the different kinds of stone. Some of the rock seems to be in crystals and some in ordinary flake stone. Which is the better for agricultural purposes?

The Fields Division :—

To effectively burn lime for building and agricultural purposes there is no simple method. The only way is to erect a kiln of brick or stone, and to place

the broken limestone (medium-sized pieces) and slack coal or lasting wood in alternate layers, commencing first with the wood. Limestone should be heated to redness for producing quick or oxide of lime. If there is too much sand or clay in the limestone there is a danger of fusing or running together, forming dead burnt lime. As a rule, crystalline limestone is the richer in lime. In this class is marble, which is the purest limestone procurable. The amorphous or flake limestones usually contain more impurities, in the form of sand principally. To determine which is better limestone to burn in your locality, you should get samples analysed or consult a list of analyses of North Island limestones (including a number in the Whangarei district) that appeared in the September, 1915, issue of the *Journal*.

TREATMENT OF BREEDING-SOWS.

"PIG," Himatangi :—

Can you inform me of any wash suitable for sows? I cannot get mine to hold. I first mated them with a boar which has a record for getting big litters, and secondly with a young active boar, and still they come back. They have a good run, are fed on whey, and are in good condition.

The Live-stock Division :—

This trouble may be due to an undue secretion of acid fluid from the lining membrane of the parts, and an alkaline wash may be beneficial. The treatment necessary is to irrigate the passage just before service with a solution composed of ½ oz. of bicarbonate of soda (baking-soda) to a pint of warm water. The sows should have exercise and not be in high condition before going to the boar. The Department's bulletin on "Pig Breeding and Management" has been sent to you.

SPRAYING-COMPOUNDS.

W. MITCHELL, Whangarei :—

In view of the high price of sulphate of copper, I would ask whether sulphide-of-iron solution would be effective for winter spraying of peach-trees for curl. Twenty-five gallons of solution would be prepared from 5 lb. sulphate of iron and 1½ pints lime-sulphur solution (33° test), and be used in the proportion of 1 gallon sulphide-iron solution to 9 gallons water.

The Horticulture Division :—

Sulphate of iron treated in any form is not equal to sulphate of copper as a fungicide. Sulphide of iron prepared somewhat after the manner stated, but used at considerably reduced strength, makes a useful summer remedy for powdery mildew, but the fungicidal properties mainly exist in the sulphur content of the mixture; and for winter purposes we should rather rely upon the lime-sulphur solution.

CYSTS IN SHEEP.

"SHEEP-FARMER," Blind River, Marlborough :—

Could you give me any information regarding small white worms sometimes found in the flank of sheep when killed? Out of a small line of twenty-three fat ewes slaughtered for freezing four were rejected on account of worms described above.

The Live-stock Division :—

These bodies (*Balbania gigantea*), which somewhat resemble worms, are millet-grain to hazelnut sized yellowish-white cysts with suppurative contents. They are found principally in old ewes, and can be seen in the intermuscular tissues in various parts of the carcase. So far as we know, no measures can be taken to prevent this trouble in sheep. It is always advisable to have a rock-salt lick in the paddocks, but it is not necessarily a corrective for this complaint.

SCALES ON LEMON.

CLEMENT TAYLOR, Tauranga :—

My lemon-trees are affected with a sort of hairy scale on the trunk and branches. The lemons themselves are sometimes covered with a scale which peels off easily when scratched. Will you kindly give me advice in the matter?

The Horticulture Division :—

There are a number of different scale insects which affect citrus fruits. We should advise you to forward specimens for identification. To destroy scale affecting lemon-trees spray with emulsified oil at the ratio of 1 in 25; if possible, twice between the months of May and August. The work must be thoroughly done.

MOLASSES WITH HAY.

"SUBSCRIBER," Tawa Flat :—

Will you kindly advise me as to the best method of using molasses with hay for cows?

The Live-stock Division :—

The usual method of using molasses with hay is to mix a certain amount of water with the molasses and sprinkle over the hay. A little salt added is beneficial.

TREATMENT OF FOOT-ROT IN SHEEP.

"LAMBS," Bay of Plenty :—

What is a good cure for foot-rot in sheep?

The Live-stock Division :—

The general practice for the treatment of foot-rot is to use a solution of arsenic, and the best way to apply the preparation is to put it in a foot-bath and drive the sheep through. A stout wooden trough, 12 ft. long by 18 in. wide by 6 in. high at the sides and ends, should be made. Battens should be placed across the bottom to prevent the sheep slipping. Hurdles are placed securely on each side, and on the entrance and exit, forming a race, wing hurdles being placed at the entrance. The exit should be into some bare yard or land capable of holding the sheep half an hour or so, until the feet dry. If they are put directly on to grass land the solution will drip on to the grass, and any animal eating the latter would probably be poisoned. The solution is made by boiling 2 lb. of white arsenic with 2 lb. of carbonate of potash (pearlash) in a gallon of water, over a slow fire, until the arsenic be dissolved. Arsenic by itself is only feebly soluble in water, and such solution would be no good. To the compound add 5 gallons of water. Sufficient solution may then be put into the bath to cover the feet, and the sheep walked slowly through, adding more solution from time to time to keep up the level. The operation is better done in dry weather. If the sheep are fairly sound, putting them through every couple of months should be sufficient as a preventive. Of course, if necessary, and if they have actually got foot-rot, they could be put through much oftener. Special care should be taken to keep the trough, utensils, &c., in a safe place when not in use, as arsenic is very poisonous. Wool placed in the bottom of the bath and saturated with the arsenic solution will prevent splashing.

A more effectual and less dangerous substitute would be sulphate of copper (bluestone). A convenient preparation can be made by carefully mixing over a slow fire 1 part of powdered bluestone with 1 of lard and 2 of tar. This is applied to the affected feet after removal of loose and diseased horn.

NOTICE.—A query signed "Waimate," Waterton, cannot be answered unless correspondent's name is forwarded.—EDITOR.

COMMERCIAL INTELLIGENCE.

EGYPTIAN PHOSPHATE PROPERTY FOR SALE.

NOTICING the attention now being given in New Zealand to Egyptian phosphate, Messrs. E. W. Morgan and Co. (Limited), of 3 Fenchurch Buildings, Fenchurch Street, London E.C., have informed the High Commissioner that they have a phosphate property in Egypt which they are willing to sell. Particulars are given by the firm as follows :—

"Jebel Duwi, where the property is situated, is nine miles and a half from the Port of Kosseir, thirty-one miles south of Safaga Bay. The phosphate-bed is 590 ft. above sea-level, with easy gradient to the Port of Kosseir, where we have license from the Egyptian Government for shipping facilities. The working-costs are light. Our engineer estimates the probable amount of mineral on our area at two and a half million tons, and the result of Dr. Dyer's analysis showed tribasic phosphate at 69·05 to 69·75 per cent. Plans and reports can be seen at our office."

The above is published for the information of any co-operative body of farmers or private capitalists who are interested in the important matter of phosphate-supplies for this Dominion and may desire to communicate with the firm named.

BUTTER AND MARGARINE.

THE photograph on the next page, forwarded by the New Zealand Dairy-produce Inspector, London, Mr. W. Wright, shows a window display of margarine and New Zealand butter at a high-class provision establishment in Liverpool. Mr. Wright accompanies the photo with the following remarks :—

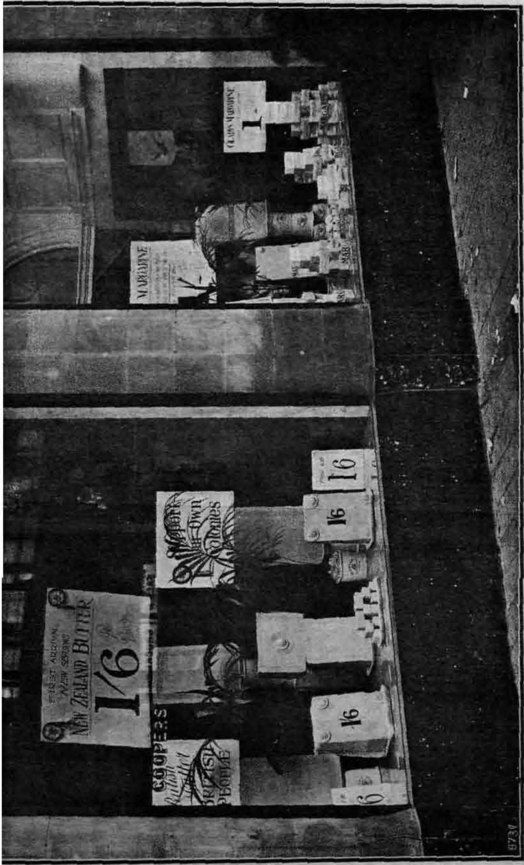
"The photograph is of more than passing interest because it illustrates the close proximity of margarine to butter in the provision trade. It will be seen that although one full window space is allotted to butter, the next window is equally well filled with a tastefully arranged display of margarine. The picture will convey to dairy-farmers in New Zealand the keenness of competition between margarine and butter in the provision trade to-day.

Incidentally this photograph is of further interest as demonstrating the retail sale of New Zealand butter under its own name in an English provincial city.

LONDON WOOL-SALES.

THE High Commissioner cabled under date 5th May regarding the closing of the third series of London wool-sales, as follows :—

The wool-sales closed with a brisk demand, a strong market, and favourable prospects. The high prices are very likely to continue. The slight decline at the opening sales was only temporary. Estimated values now are: Fine crossbreds, 1s. 9d. to 1s. 10¾d.; medium crossbreds, 1s. 6d. to 1s. 8d.; coarse crossbreds, 1s. 4d. to 1s. 6d.; superior merino, 1s. 8d. to 1s. 10d.; medium merino, 1s. 4d. to 1s. 7d.; inferior merino, 1s. 1d. to 1s. 3d. 4,600 bales of New Zealand wool were held over.



DISPLAY OF MARGARINE AND NEW ZEALAND BUTTER AT A LIVERPOOL PROVISION-STORE.

(See opposite page.)

SEED-TESTING BY THE DEPARTMENT.

THE seed-testing operations of the Department having attained considerable dimensions, it was recently decided that a charge should be made to merchants for all seed-testing done on their behalf in the Biological Laboratory. This decision was promoted by the feeling displayed by many seed-merchants that a charge is quite justified, and desired by them. An efficient staff has been specially trained for the work, and the testing can now be done accurately and expeditiously.

Charges.—The charges, which came into force on the 1st April, are fixed as follows:—

For testing for purity only	1s. per sample.
For testing for germination only	1s. per sample.
For testing for purity and germination ..	2s. per sample.
Individual seeds for identification	Free.

Particulars required.—Merchants are requested to stipulate what test is desired in the case of all samples sent in by them—*i.e.*, (1) Whether for purity only, (2) whether for germination only, (3) whether for purity and germination. When full particulars are not given, the interpretation of the word "test" or "report on" will be that purity and germination of the sample are required by the sender.

Size of Samples.—For purity, 1 oz. of the smaller seeds, such as timothy or white clover; 2 oz. of the larger seeds, such as rye-grass or red clover. For germination, smaller samples than for purity are sufficient.

Mode of Reporting.—An interim report will be sent out as soon as an indication of the value of the sample has been ascertained. This will furnish the purity quantitatively, and will give the germination after a certain number of days. If anything harmful is noted in the sample, this will be mentioned on the interim report. It is thought that these interim reports will be of great value for merchants to decide rapidly whether any line on offer is of sufficiently good quality to purchase without having to wait the extra time for a complete test.

Final Report.—This will give the final germination-capacity and the details of the purity analysis. A new form is being printed for this final report which will give the common and botanical names of most impurities found in agricultural seeds, giving their relative frequency of occurrence in samples and whether harmful or otherwise.

Telegraphing Results.—Telegrams, where requested, will be sent at the expense of the firm desiring a report by wire.

Payment of Testing Charges.—Accounts will be furnished monthly by the Accountant of the Department. No fees are to be remitted to the Biological Laboratory, but are to be paid only in response to accounts furnished by the Accountant.

In a circular embodying the above information Mr. A. H. Cockayne, Biologist, remarks as follows:—

"I should like to take this opportunity of recording my appreciation of the efforts of New Zealand seed-merchants to raise the standard of quality of farm seeds sold in New Zealand. It is hoped that the charge necessary in order to place the departmental seed-testing work on a thoroughly businesslike basis will not prevent merchants from fully availing themselves of the facilities offered."

It is pleasing to note that communications since received by the Biologist from the leading seed firms in the Dominion unanimously approve of the new system and appreciation of this branch of the work of the Biological Laboratory.

Seed-testing will still be undertaken gratis for farmers.

France and Frozen Meat.—It is now officially confirmed that the proposed French legislation for the purchase of frozen meat from certain American firms has been dropped. The despatch, dated London, 23rd March, adds that nothing is known at the British embassy in Paris of any negotiations for the purchase of any frozen meat other than Australasian meat.

" COMPILED FROM MANIFESTS OF VESSELS SAILED DURING RESPECTIVE MONTHS OF CURRENT AND PRECEDING SEASONS.

Month.		Mutton, Carcases.	Lamb, Carcases.	Beef, Quarters.	Pork, Carcases.	Butter, Boxes.	Cheese, Crates.	Wool, Bales.	Wheat, Sacks.	Oats, Sacks.	Rabbits, Crates.	Hemp, Bales.	Tow, Bales.	Kauri-gum, Pkgs.
January,	1916	166,700	295,170	41,726	179	108,593	101,917	92,849	..	..	..	7,438	1,666	1,218
"	*1915*	*137,816*	*296,439*	*45,622*	*339*	*138,081*	*85,123*	*87,393*	..	..	*2,860*	*683*	..	*1,209*
February,	1916	170,973	266,414	29,056	23	96,096	84,740	96,016	..	..	..	8,161	1,804	1,900
"	*1915*	*433,585*	*517,581*	*77,421*	*311*	*119,371*	*96,090*	*159,347*	..	..	..	*13,111*	*6,619*	*2,763*
March,	1916	327,977	363,269	83,725	..	59,671	62,082	49,750	..	..	474	2,666	637	1,247
"	*1915*	*80,439*	*203,480*	*30,176*	..	*55,280*	*51,811*	*49,809*	..	..	..	*8,410*	*185*	*274*
April,	1916	108,488	195,707	106,369	..	24,703	81,652	41,725	..	..	..	3,782	337	450
"	*1915*	*286,155*	*328,779*	*45,340*	..	*6,703*	*38,561*	*41,371*	..	..	*1,011*	*9,328*	*1,474*	*3,451*
May,	1915	257,953	433,831	34,780	655	148	17,065	21,615	..	..	2,923	4,968	808	2,636
"	*1914*	*336,632*	*638,397*	*39,315*	*54*	*837*	*37,776*	*43,364*	*3,623*	*11,062*	..	*8,355*	*2,112*	*9,316*
June,	1915	99,080	154,785	19,316	932	..	26,869	11,946	..	..	9,800	5,027	1,320	1,229
"	*1914*	*261,877*	*634,981*	*36,400*	..	*1,153*	*19,247*	*18,774*	..	*28,141*	*1,000*	*7,924*	*4,258*	*7,881*
July,	1915	243,420	340,476	21,231	154	..	21,520	16,039	..	..	5,968	5,068	1,639	4,184
"	*1914*	*225,411*	*239,143*	*38,170*	..	*1,355*	*2,003*	*15,868*	..	*1,425*	*1,000*	*5,810*	*2,584*	*8,053*
August,	1915	510,418	570,381	51,750	35	..	18,287	19,416	..	..	31,790	7,138	1,466	4,848
"	*1914*	*84,251*	*63,111*	*19,094*	*516*	*1,979*	*50*	*4,845*	*600*	*38,220*	*10,403*	*367*	*245*	*3,705*
September,	1915	299,715	330,643	59,487	..	26,416	2,595	5,360	..	..	7,750	2,022	3,091	595
"	*1914*	*53,386*	*49,200*	*2,353*	..	*15,885*	..	*3,337*	..	*5,896*	*7,288*	*1,143*	*57*	..
October,	1915	367,198	417,794	87,104	..	111,468	49,160	7,272	..	..	56,636	5,650	1,645	1,230
"	*1914*	*291,432*	*128,016*	*49,104*	..	*81,842*	*30,487*	*8,938*	..	*68,660*	*38,121*	*2,042*	*1,650*	*1,683*
November,	1915	93,777	92,601	21,609	..	81,102	47,243	18,715	..	..	13,538	5,064	1,789	868
"	*1914*	*136,346*	*27,577*	*48,302*	*27*	*98,729*	*70,048*	*37,604*	*15*	*24,289*	*35,783*	*885*	*110*	*1,377*
December,	1915	91,124	59,231	36,467	..	214,967	81,939	33,527	..	..	3,052	6,016	1,940	5,555
"	*1914*	*192,952*	*149,835*	*44,876*	..	*172,990*	*80,144*	*86,317*	..	..	*9,306*	*1,136*	*116*	*2,157*

LONDON MARKET VALUES.

COMPARATIVE STATEMENT COMPILED FROM THE HIGH COMMISSIONER'S CABLES FOR THE PAST THREE MONTHS.

London Date.	Wool. Bradford Quotations for Tops. 36's.	40's.	44's.	50's.	56's.	60's.	Mutton. Canterbury.	Mutton. North Island.	Lamb. Canterbury.	Lamb. Other than Canterbury.	Beef. New Zealand Hinds.	Beef. New Zealand Fores.	Butter. Danish.	Butter. New Zealand.	Cheese. New Zealand White.	Cheese. New Zealand Coloured.	Cheese. Canadian.	Hemp (Spot). New Zealand Good-fair.	Hemp (Spot). New Zealand Fair.	Hemp (Spot). Manila Fair (New Grade).	Hemp (Forward Shipment). New Zealand Good-fair.	Hemp (Forward Shipment). New Zealand Fair.	Hemp (Forward Shipment). Manila Fair (New Grade).	Wheat. N.Z. Short-berried.	Wheat. N.Z. Long-berried.	Oats. N.Z. Sparrowbills.	Oats. N.Z. Danish.
1916.							d.	d.	d.	d.	d.	d.															
Feb. 12	..	..	..	..	..	..	7⅝	7½	8	8	6½	5½	160/0	153/0	..	..	97/0	..	..	..	..	..	55/10/0	..	..	..	..
" 19	2/3½	2/5	2/6	2/11	3/4	3/8	7⅝	..	8½	*9	6½	5½	166/0	155/0	95/0	96/0	99/0	47/10/0	45/10/0	56/0/0	47/0/0	45/0/0	..	..	..	..	..
" 26	2/3	2/4½	2/5½	3/10½	2/3½	3/7½	7⅝	..	8½	*9	6½	5½	174/0	159/0	95/0	96/0	99/0	49/10/0	45/10/0	..	46/10/0	44/10/0	55/10/0	..	..	..	..
March 4	..	..	..	..	..	..	7⅝	7⅝	8½	*8¾	..	..	179/0	162/0	97/0	98/0	99/0	..	..	..	46/15/0	45/5/0	56/10/0	..	..	..	..
" 11	..	..	..	..	..	..	7⅝	7⅝	8½	*8¾	..	..	182/0	163/0	99/0	99/0	103/0	47/0/0	45/10/0	57/0/0	46/10/0	44/10/0	56/0/0	..	..	..	..
" 18	..	..	..	..	..	..	7⅝	7⅝	8½	*8¾	6½	5½	181/0	163/0	102/0	103/0	105/0	..	46/0/0	56/10/0	46/5/0	44/5/0	55/0/0	..	..	..	..
" 25	..	..	..	..	..	..	7⅞	7⅞	*9	*9	..	..	178/0	163/0	102/0	103/0	106/0	..	..	55/0/0	..	45/5/0	..	..	..	..	..
April 1	..	..	..	..	..	..	7⅞	7⅞	*9	*9	..	..	172/0	163/0	103/0	103/0	107/0	47/10/0	45/10/0	..	46/10/0	44/10/0	..	..	..	..	..
" 8	..	..	..	..	..	..	7⅞	7⅞	8¾	8¾	7	6	174/0	163/0	103/6	103/6	107/0	49/0/0	47/0/0	54/0/0	47/10/0	45/10/0	53/0/0	..	..	..	..
" 15	..	..	..	..	..	..	7⅞	7⅞	8¾	8¾	7	6	175/0	163/0	105/0	105/0	107/0	49/10/0	47/10/0	53/0/0	50/0/0	47/0/0	..	..	..	..	..
" 20	..	..	..	..	..	..	7⅞	7⅞	8¾	8¾	..	..	173/0	163/0	105/0	105/0	108/0	49/10/0	..	55/0/0	48/10/0	46/15/0	51/10/0	..	..	..	..
" 29	..	..	..	..	..	..	7⅞	7⅞	8¾	8¾	..	..	169/0	163/0	107/0	107/0	109/0	49/0/0	47/0/0	..	..	..	..	..	..	..	..
May 6	..	..	..	..	..	..	7⅞	7⅞	8¾	8¾	6½	6	170/0	164/0	110/0	110/0	112/0	50/0/0	48/0/0	..	48/10/0	46/10/0	54/10/0	..	..	..	..
" 13	..	..	..	..	..	..	8⅛	8⅛	9	9	..	..	172/0	165/0	113/0	113/0	115/0	50/0/0	48/0/0	56/0/0	49/0/0	47/0/0	55/0/0	..	..	..	..

STOCK EXPORTED.

THE following table shows the number and descriptions of stock exported from the Dominion during the month of April, 1916:—

Port of Shipment.	Horses.		Sheep.		Cattle.		Pigs.
	To Australia.	To Eastern Pacific.	To Australia.	To Eastern Pacific.	To Australia.	To Eastern Pacific.	To Eastern Pacific.
Auckland	..	147	..	..	..	..	..
Gisborne	..	..	..	..	..	..	..
Napier	..	..	..	..	..	..	..
Wellington	22	..	..	..	1	..	..
Lyttelton	30	..	122	..	17	..	..
Dunedin	..	..	100	..	..	..	..
Bluff	3	..	..	..	..	..	..
Totals	55	147	222	..	18	..	..

Auckland also exported 2 crates of poultry.

Wellington exported 24 mules to the eastern Pacific.

The following are particulars of horses shipped: 15 draught stallions, 4 mares; 1 pony colt; 2 trotting geldings, 4 mares, 2 colts; 8 thoroughbred fillies, 17 mares, 2 colts.

STOCK IN QUARANTINE.

THE following stock was received into quarantine during the month of April, 1916:—

No.	Description.	Sex.	Port of Origin.	Owner or Agent.	Address.
			MOTUIHI ISLAND (AUCKLAND). Nil.		
			SOMES ISLAND (WELLINGTON).		
3	Aberdeen-Angus heifers	Female	London ..	A. S. G. Carlyon..	Hawke's Bay.
1	Collie bitch ..	,,	,,	R. Dixon ..	Wanganui.
6	,, pups ..	..	..	,, ..	,,
1	Trotting stallion	Male ..	San Francisco	C. Hudson ..	Dunedin.
			QUAIL ISLAND (LYTTELTON).		
1	Collie ..	Female	London ..	James Lilico ..	Lochiel.
3	Collie pups ..	,,	,, ..	,, ..	,,
2	,, ..	Male ..	,, ..	,, ..	,,
2	Pomeranian ..	Female	,, ..	W. Brittenden ..	Christchurch.
2	Pomeranian pups	,,	,, ..	,, ..	,,

HEMP AND TOW GRADING RETURNS.

APRIL.

Hemp.—The total number of bales graded was 13,809, as compared with 9,633 for the corresponding month of last year, an increase of 4,176 bales. For the twelve months ending 30th April, 1916, the number of bales graded was 142,058, as compared with 82,477 for the previous twelve months, an increase of 59,581 bales.

Tow.—During the month 3,512 bales were dealt with, as compared with 2,740 for the corresponding month of last year, an increase of 772 bales. For the twelve months ending 30th April, 1916, the number of bales graded was 39,660, as compared with 23,338 for the previous twelve months, an increase of 16,322 bales.

Stripper-slips.—The number of bales graded was 532, as compared with 153 for the corresponding month of last year, an increase of 379 bales. For the twelve months ending 30th April, 1916, the number of bales graded was 6,254, as compared with 1,394 for the previous twelve months, an increase of 4,860 bales.

HEMP, TOW, AND STRIPPER-SLIPS GRADED THROUGHOUT THE DOMINION DURING THE MONTH OF APRIL, 1916.

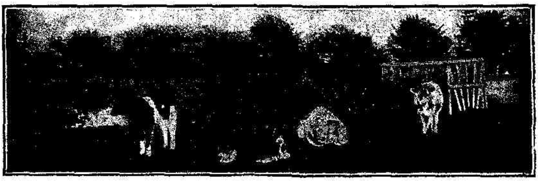
Hemp.

Port.	Superior.	Fine.	Good-fair.	Fair.		Common.	Rejected.	Condemned.	Total.
				High Point.	Low Point.				
	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.
Auckland ..	..	..	171	597	1,264	581	109	..	2,722
Napier ..	..	..	85	..	..	..	..	..	85
Foxton ..	...	..	1,683	1,382	1,033	229	32	2	4,361
Wellington ..	..	45	936	2,314	1,219	184	25	..	4,723
Picton ..	..	48	79	..	..	..	..	..	127
Blenheim ..	..	..	201	15	63	..	..	..	279
Lyttelton ..	..	..	..	..	..	..	..	..	..
Dunedin ..	..	..	23	151	26	7	..	..	207
Bluff	..	..	195	796	311	3	..	..	1,305
Totals ..	..	93	3,373	5,255	3,916	1,004	166	2	13,809
Percentages of totals	..	0·68	24·43	38·06	28·36	7·27	1·20	..	..

Tow.

Port.	First Grade.	Second Grade.	Third Grade.	Condemned.	Total.
	Bales.	Bales.	Bales.	Bales.	Bales.
Auckland ..	..	259	790	151	1,200
Napier	..	7	..	..	7
Foxton	175	373	74	..	622
Wellington ..	137	508	296	10	951
Picton	14	13	..	..	27
Blenheim ..	4	151	..	..	155
Lyttelton ..	..	..	..	..	..
Dunedin ..	..	73	4	..	77
Bluff	..	48	378	47	473
Totals ..	330	1,432	1,542	208	3,512

Stripper-slips.—Auckland: Second grade, 2; condemned, 22. Foxton: Second grade, 227; condemned, 10. Wellington: First grade, 94; second grade, 108; condemned, 8. Blenheim: Second grade, 23. Dunedin: Second grade, 20; condemned, 4. Bluff: Second grade, 14.



The

Journal of Agriculture.

WELLINGTON, NEW ZEALAND.

20TH JUNE, 1916.

CONVERSION OF FERN-LAND INTO GRASS.

A. H. COCKAYNE, Biologist.

INTRODUCTION.

THE sown grass-lands of New Zealand not entering into any special rotational system are of particular interest, owing to their being in general of quite recent origin. Although there are grass-lands in the Dominion that have been established over half a century, all the various types of pasture can be traced right from their primeval condition to their present state. All the changes and modifications of vegetation that occur in their development can be studied step by step from the original plant-formation into grass-land, the derivation of which it would be impossible to tell from its present condition alone. In all parts of New Zealand, but more extensively in the North Island, the evolution of artificial pastures can be seen in all its varied phases, and the origin of artificial grass-land can be investigated with a detail that is impossible in older-settled countries, where the origin of many of the types of permanent pasture is wrapped in obscurity.

of "bush-burns" in general can be relegated to rain forest, and the grass-land derived from it comprises much of the very best of the permanent grazing-land of New Zealand.

Southern-beech Forest Grass-land.—This occupies a comparatively small area, and forest-land of this type is amongst the most difficult of any in New Zealand to grass successfully. In many cases the earlier attempts resulted in failure, as can be well seen on the low hills along the eastern side of the Hutt Valley, near Wellington, where the land has in many cases reverted to manuka.

Tussock Grass-lands.—These are mainly located in the South Island, and are of various types. Much of the land originally covered with the lowland tussock type is now under rotational grass, nearly all the cereal-growing districts having been lowland tussock in the past. In Southland large areas of tall tussock (*Danthonia Raoulii*) moor have been converted by drainage and liming into both rotation and permanent grass-land.

Reclaimed-swamp Grass-lands.—This type of pasture is scattered throughout both Islands, and many of the areas comprise the best fattening-land in the Dominion. Their conversion has been attended with much difficulty, and the great expenditure necessary to drain them sufficiently to grow grass has been a bar to their rapid conversion into grass-land.

Heath Grass-lands.—These have been derived from two main types—wet heath, being very closely related to moor, and dry heath, mainly comprising fern-land and manuka scrub.

The above classification is an extremely rough one, but it serves to show from what varied types of original vegetation our grass-lands have been derived.

THE CONVERSION OF FERN-LAND INTO GRASS.

In dealing with the conversion of fern-heath into grass it is well to understand that there are two main types of fern-land. The first is what I term natural fern-land, and which has been continuously in fern, even prior to the time that the first Europeans landed in the country. The other type, which I term artificially induced fern-land, did not carry fern before being brought under occupation. Fern-land in New Zealand occupied very large areas prior to the advent of settlement; but, arguing from what has occurred over a very large extent of bush-burn country, I am inclined to think that much of the land now occupied by what appears to be a primitive vegetation became clothed with fern subsequent to extensive forest fires occurring in

the pre-European days of this country. It is a notable fact that many types of New Zealand forest-land when burnt and then left unstocked do not as a normal rule reproduce forest, but turn rapidly into fern. This feature is of such an outstanding nature that it would appear safe to generalize and say that all fern-lands in New Zealand, both primitive and induced, with a few notable exceptions, occupy the site of former forest, and that a plant *covering of fern is one of the stages through which, under natural* conditions, the land must pass before forest is again developed.

OLD FERN BURNT PREPARATORY TO EITHER PLOUGHING OR SURFACE-SOWING.

When this view is taken it is seen that there is not much difference in origin between natural and artificially induced fern-land—the destruction of forest, either naturally or artificially, being the all-essential requisite for the production of both types. If the history of the vegetation were carried back far enough to the plant-colonization of actually virgin ground, it seems feasible to expect that fern in all cases preceded the development of forest. A study of the fern-lands of the Central Volcanic Plateau seems to fit in well with this hypothesis.

There is, however, a very signal difference between natural and artificially induced fern-lands. The vegetation of the former is

of very considerable age, whereas that of the latter is of very recent origin, and its actual commencement can be seen in many parts of New Zealand. In addition to this, the vegetation of natural fern-land is much easier to eradicate than that of artificially induced fern-land. In certain cases quite light stocking of primitive fern-land has resulted in the eradication of the fern, as, for instance, in the Te Kuiti district, where fern-land has frequently been successfully broken in and the fern got rid of by stocking with milking-cows alone. Artificially induced fern, when properly established, could not possibly be dealt with in this way. The greater difficulty of dealing with induced fern is probably due to the fact that much natural fern-land, especially where tutu is becoming abundant, is in one of its later stages of development before the land again becomes clothed with forest, and the fern is naturally not so aggressive as when in the stage immediately following its successful invasion of previously forested country.

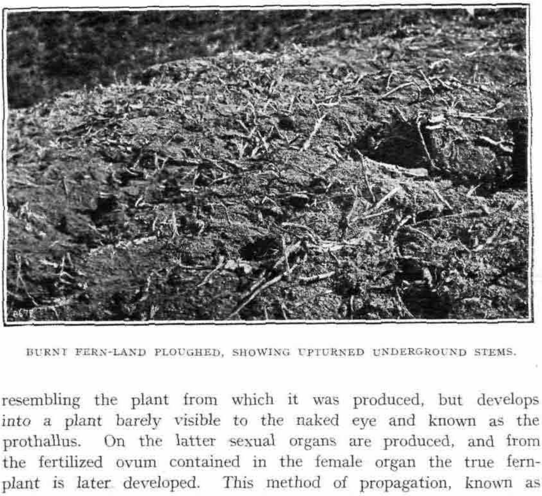
The grass-lands that have been converted from the type of heath I term natural fern-land are of very considerable extent, comprising some two million acres, the larger portion being located in the east coast region of the North Island, and also in the southern portion of the Auckland Province. Much that has been converted for many years—and this is particularly true of large areas in Hawke's Bay—no longer shows any signs of ever having been covered with a dense growth of fern, but the ready development of the plant on unutilized land adjoining such grass-lands shows clearly the previous condition of the land. During the past few years there has been a great extension in the work of converting fern-land in the King-country, and large areas still remain to be transformed into pastures. In this district all stages in the conversion of fern-land into grass can be seen—from those where the dominance of the fern is quite unaltered to those where fern is apparently quite non-existent.

With regard to the eradication of fern on artificially induced fern-land much work has been accomplished, and many hundreds of thousands of acres where fern had attained the mastery over grasses sown on bush-burns have been more or less cleared of the weed. In many places, however, such as the Marlborough Sounds, artificially induced fern-land covers large areas, and the eradication of the fern is yearly becoming more difficult. Theoretically, induced fern should not exist, provided proper methods to avoid its establishment were carried out, and it is probable that with a better knowledge of the necessary initial treatment of bush-burns the development of artificially induced fern could be enormously diminished.

Before detailing the methods of fern-land conversion it will be well to give some details concerning the life-history of fern and the general principles underlying its eradication.

THE LIFE-HISTORY OF FERN.

The dominant plant of fern-land, both natural and induced, is the bracken fern (*Pteridium esculentum* (Forster, F.), L. Cockayne). This plant is closely related to the European bracken, but is considered to be a distinct species. Like all ferns, it reproduces itself by spores, and not by seeds, as is the case in the higher plants. The spore on germination does not give rise to an individual



BURNT FERN-LAND PLOUGHED, SHOWING UPTURNED UNDERGROUND STEMS.

resembling the plant from which it was produced, but develops into a plant barely visible to the naked eye and known as the prothallus. On the latter sexual organs are produced, and from the fertilized ovum contained in the female organ the true fern-plant is later developed. This method of propagation, known as the sexual method, is often overlooked in the case of bracken fern, on account of the tremendous power of vegetative reproduction with which the ordinary spore-bearing fern-plant is endowed.

The two most conspicuous features of the bracken fern — or simply "fern," as it is generally termed in New Zealand—are its fronds that rise above ground, and its thick underground stem that penetrates deeply into the soil. This stem is popularly spoken

of as the "root," but the true roots are comparatively slender organs arising from the stem, especially at some distance behind the white-tipped growing point. The underground stem contains very large quantities of starch, which is manufactured in the aerial portions of the plant and transferred to the stem. This starch is utilized in the production of fresh underground-stem development, and especially for the maintenance of the young fronds until such time as they uncurl. The underground stem gradually dies back from its older end, but considerably less slowly than new growth is produced at its growing points.

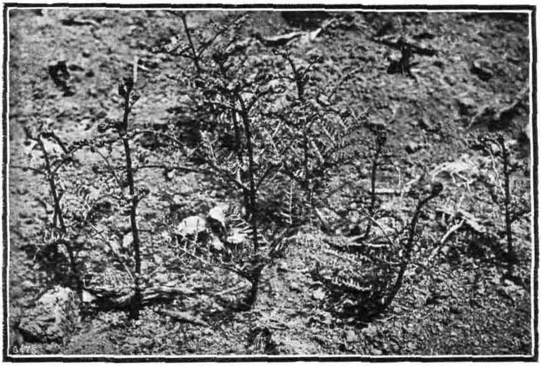
It will be noted that the development of the underground stem of fern is analogous to that of the ordinary Californian thistle; and the plant when once established can spread over a very large area of ground in a comparatively short space of time. However, there is an extremely important difference between the underground stem of fern and the underground stem of Californian thistle. From any portion of the underground stem of the thistle, especially if cut, buds can be developed, and each cut portion can thus give rise to a separate plant. When the fern-stem is cut the case is very different, and it is only those portions that have a frond developed on them or possess a growing point that can develop into separate plants. Any portion of the stem devoid either of a frond or of a growing point will die when cut in pieces. This fact—an important one—explains how ploughing or disking fern will thin it out considerably, while the same treatment on Californian thistle will only increase the vitality of the plant.

Another extremely important character of fern is the fact that if the frond is cut no further growth of that particular frond can take place. A fresh frond has to be developed from below the base of the cut one, and in this operation, again, a great deal of the reserve food in the underground stem is employed. It is thus seen that the whole of a frond of fern, no matter how large or small it may be, is merely a single leaf, and this fact has an immense bearing on successful eradication.

A further character of New Zealand bracken is that it is what it is termed a light-demander, and the growing of a crop that completely shades it will cause its early extinction. This point is not of any value so far as the average farmer is concerned, but from a forestry standpoint it is of especial significance. The fronds, however, have a great power of elongation, and in moderately shaded forests and on their outskirts the fronds, in their efforts to reach the light, may attain a height of 20 ft. or more before they uncurl. Such growth, however, is an immense tax on the reserve food-supply, and death rapidly occurs unless the efforts

of the fronds to reach the light are successful. This explains the complete absence of bracken in dense forest. Wherever forest becomes open, and on the outskirts, fern rapidly puts in an appearance to the point where the vertical depth of the forest shade is too great for the fronds to penetrate.

Another feature of fern — and this an important one from the eradication aspect — is the fact that the development of fronds more or less ceases from the late autumn to the late spring or early summer. In certain districts the fronds virtually die in the winter, but this is by no means universal, and in many localities,



YOUNG FERN IN PLOUGHED LAND, JUST COMING OUT OF CURL STAGE.
A little too advanced for sheep, but right for crushing by cattle.

especially in the North, the plant is truly evergreen. This cessation of growth is of importance, taken in conjunction with its other peculiarities that have been mentioned, but is not of itself sufficient to make the plant comparatively easy to eradicate under certain conditions. Californian thistle also undergoes a somewhat similar dormant period, but that does not make it any the easier to destroy.

Bracken does not seem at all particular as to what type of ground it occupies, and it is found abundantly on all classes of New Zealand soils. It is frequently asserted that fern is an indication of acid soils; and that it exerts a toxic effect on other types of vegetation, but more particularly on grass, is a common belief.

Whether fern is generally indicative of acid soils or not I cannot say, but it certainly does not object to what in New Zealand is termed limestone country. In the Te Kuiti district it grows abundantly actually on the limestone outcrops; and in a large part of that neighbourhood red clover flourishes amazingly on the fern-lands during the process of their conversion into permanent grass. If fern is taken as an indication of acid soil, then the soil on the sides of the railway from New Plymouth to Wellington —covered as it is with an almost unbroken line of induced fern, and adjoining some of the most highly prized agricultural land of the Dominion—should be of an acid nature. It would be interesting to ascertain the acidity of the soil along the railway-fence where this induced fern is growing—say, in the vicinity of Hawera —and compare it with the grass-land devoid of fern immediately adjacent.

A factor, however, that does act detrimentally on the growth of fern is altitude, as can be clearly seen by an examination of the Mount Egmont district, where the altitudinal limit of bracken is well under 3,000 ft. In places I know it ascends higher, but in general it can be looked upon as a serious pest only between sea-level and 2,500 ft.

The great and rapid development of the aerial portions of the bracken fern and the general unpalatability of the expanded fronds, together with the deep and powerful underground stem filled with reserve food, would appear to make this plant almost impossible of eradication. Yet with all its obvious advantages for holding possession of the ground it possesses four fatal defects that make its control possible. These are the incapacity of the underground stems to develop fronds except in specially defined places, the inability of the frond to grow when once broken off, the extreme ease with which the frond may be broken before it expands or when it is in what is known as the curl stage, and the long dormant season extending from autumn to late spring.

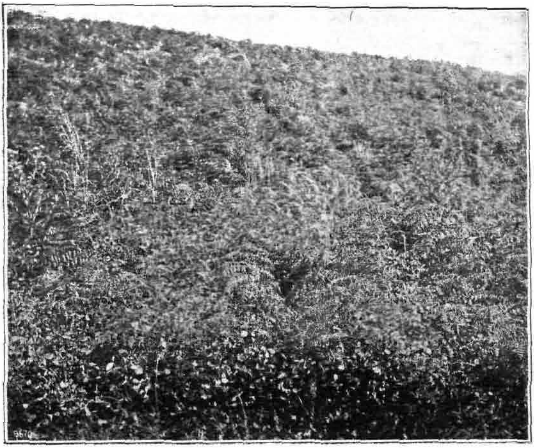
In the conversion of the fern-land into grass all these defects should be taken into consideration, but in many cases the measures necessary to direct against these vulnerable points cannot be practically carried out, and therein lies the difficulty of controlling fern over all areas where it is found.

PREPARATION OF THE SEED-BED FOR GRASS.

For various reasons it is well to discuss first the methods of natural fern-land conversion, and afterwards give some attention to those of induced-fern country, as certain special factors operate in

the greater part of the country of the latter type. In the conversion of natural fern the preparation of the seed-bed is the first essential. It is only in certain instances, and where by quite ordinary stocking methods the fern will finally disappear and grass-land assert itself almost naturally, that no attention need be paid to this matter.

In general, the first procedure to adopt is to burn the fern. Care should be taken to isolate the area to be burnt, so as to



AUTUMN-SOWN TEMPORARY PASTURE, ONE YEAR OLD.
Showing fern left rather long before feeding down the area with cattle.

avoid burning a larger area than was intended. There is a general consensus of opinion that fern should be burnt only in the autumn, but there is no really valid reason for this so far as the fern itself is concerned. In fact, midsummer burns, provided the grass sown can come away rapidly and be stocked before the fresh fern-growth develops, would be preferable to autumn burns. The reason is that in the summer the fern-stems are less provided with reserve food than in the autumn, and, provided each growth of fresh fronds can be broken off or eaten by stock while yet in the curl stage,

the eradication of the fern must be sooner accomplished than if burning is delayed. This system was in past times extensively followed by the late Archdeacon Williams on the east coast of the North Island; but, of course, the practice is unusual. The reason is obvious. In general, midsummer sowing of surface-sown grass is not likely to be uniformly successful, and heavily stocking a bad take of grass punishes the stock too much for such an operation to be entertained at the present day. Thus autumn burning not earlier than the end of February can be looked upon as the general practice for surface-sown fern-lands.

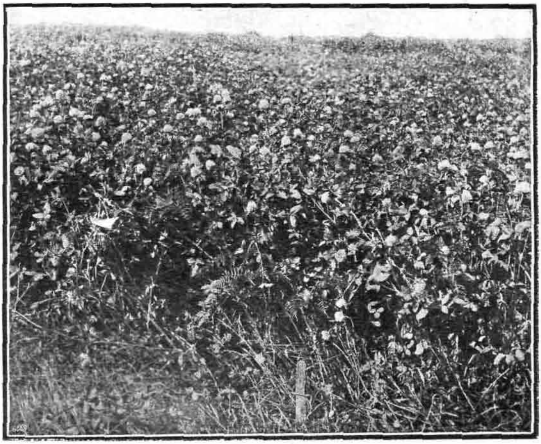
On fern-land that is ploughed the burning often takes place earlier, and the ground is stocked for a few days after the young fern appears after ploughing, the ground being thereby consolidated before the seed is sown in the autumn. On fern capable of being ploughed this operation should always be carried out and the land worked up in the ordinary manner. Many consider disking is preferable. It certainly has the merit of cheapness, and the cutting of the fern "root" is also highly desirable. Ploughing and disking, however, would be better. Where land cannot be ploughed the seed should be sown after the land has been somewhat consolidated by rain, or a temporary stocking to harden the ground should take place.

THE SEED MIXTURE.

In certain cases on a first-ploughed fern-burn turnips are sown, and at times even two successive crops are taken off before the ground is laid down to grass. Such methods, however, are applicable only on land where the fern is not particularly vigorous. I am inclined to think that in nearly all instances on ploughed fern-land a seeding with a temporary grass mixture is preferable to immediate conversion into permanent pasture. This is now a regular practice, and the mixture used should consist of about 15 lb. Italian rye-grass, 8 lb. cow-grass, 2 lb. white clover or alsike, and perhaps a little cocksfoot. In a couple of seasons under cattle-stocking such a pasture will be almost entirely cow-grass, and a preliminary crop of this description leaves the ground in excellent condition for the later permanent mixture sowing, and also even for the production of annual crops, both of a forage or cereal nature. The permanent mixture may be sown after the ploughing of the clover sod, but excellent results also follow harrowing the clover in the autumn and sowing almost immediately after. The temporary clover may remain from two to six years before being resown, its duration depending entirely on the condition of the pasture when the permanent mixture is sown. As much as 30 lb. of seed

per acre should be used, of which at least 10 lb. should be cocksfoot. The actual species used in the permanent mixture varies in different localities. Crested dogstail, *Poa nemoralis*, and perhaps timothy, should always be included in addition to clovers and ryegrass. Meadow-fescue is also well worth a place, and not less than 5 lb. per acre should be sown.

Ploughable fern-land is generally of quite good quality except in areas containing large amounts of "raw" pumice, such as is found on the Central Volcanic Plateau. The grassing of fern-land of



TEMPORARY PASTURE — MAINLY RED CLOVER.
Land ploughed four years out of tall fern.

the latter type is not yet in a satisfactory state, and many local problems present themselves. On the better-class fern-land, however, the ultimate aim should be pastures largely composed of cocksfoot and white clover, such as are the dominant pastures of ordinary rain-forest grass-land.

On surface-sown ploughed fern-burns the permanent mixture has to be sown as soon after burning as suitable, and should be similar to that sown on the ploughed land. If the land is poor, grasses such as *Danthonia pilosa* and red- or brown-top should be

included, and also about ½ lb. *Lotus angustissimus*. I should also advise including at least 2 lb. of *Poa pratensis* on all unploughable fern-burns.

The following table of mixtures, compiled from seed-merchants' order-books—all with the exception of the first three having been actually used during the past two seasons — indicates the wide range of variations that occur in fern-country sowings. This is to be expected when the very different classes of country occupied by fern is taken into consideration. It will be noticed that in the majority of the permanent mixtures cocksfoot occupies pride of place, and, in fact, is only excluded in one purely temporary mixture. In one mixture it will be noted that sixteen different species are included, many in small quantities evidently of a purely experimental nature. In many cases yarrow, from ⅛ oz. to ¼ oz. per acre, is also included in the mixtures. I am highly dubious of the value of this plant on fern country. Again, several of the mixtures represent very light sowings. This is a great mistake, and is done in nearly every case because the farmer is not sure whether he will be able to carry out the necessary measures to control the fern; accordingly he is apt to make his mixture as cheap as possible, so that if failure follows the monetary loss is not great.

GRASS-SEED MIXTURES ACTUALLY USED ON FERN-LAND.
(Pounds per Acre.)

Rye-grass, perennial	..	2	6	2	6	..	5	4	6	3	5	4	4	5½	9	4	6	4
Rye-grass, Italian	..	..	..	1	..	15	2	2	3	3	3	4	10	5	2	2	3	2
Cocksfoot	..	1	2	5	3	..	8	8	8	6	7	6	4	10	8	6	16	10
Crested dogstail	..	1	1	..	4	..	1	2	1	..	1	½	..	1	1	2	1	2
Timothy	..	..	..	1	..	..	½	..	..	..	2	½	..	..	1	..	..	2
Poa pratensis	1	1	..	..	1	..	..	..	..	1	..	..	..	..	1	1	..	½
Meadow-fescue	..	..	..	..	..	..	2	1	..	..	2	..	..	..	..	2	..	2
Sheep's fescue	1	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	½
Chewings fescue	1	..	..	..	..	..	..	..	1	..	1	½	..	..	1	1	..	½
Poa nemoralis	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	½
Danthonia pilosa	4	4	..	1	..	..	..	2½	½	3	..	3	..	..	1	4	..	1
Brown-top	..	..	..	..	..	..	..	..	½	3	½	3	..	..	..	..	..	..
Cow-grass	..	..	½	3½	..	6	3	2	..	..	3	3	4	4	1	1	2	1
White clover	..	2	1	½	1	2	2	2	½	1	1	½	4	1	½	1	½	1
Alsike	..	..	..	1	..	..	..	1	3	3	..	..	..	..	..	..	..	..
Trefoil	..	..	..	..	..	..	..	..	1	1	..	1	..	..	..	..	..	1
Lotus major	1	..	..	..	..	..	..	..	..	..	..	..	..	..	½	1	..	½
Lotus angustissimus	½	..	..	..	..	..	..	..	½	1	..	..	..	..	½	½	..	½
Total pounds per acre	9½	11	11½	15	15	23	23½	23½	25	25	25½	26	26	26½	26½	26½	28½	29

THE CRUSHING OF FERN.

After autumn sowing of grass-seed takes place on fern-land there is virtually no growth at all of the fern till the late spring. The exact time the young fronds begin to shoot through the ground varies with the district. In the North the first growth is considerably earlier than at the same altitude in the South. In general, however, it can be said that the first growth will not be

pushing through the ground till the middle of October. In the winter and spring following the sowing hoggets may be grazed on the young grass, but as soon as the fern begins to show up, and before the fronds begin to uncurl, heavy stocking with cattle from eighteen months to two years of age, or sheep (for preference heavy wethers in good condition), has to be carried out. The object of heavy stocking is either to feed off or break off the young fern. While yet in the curl stage the main stem or petiole of the leaf is very easily broken off, apart from being in the young state quite relished by stock. Where there is a fair growth of grass no evil effects appear to result. At times, however, cattle when fed solely on young fern are

GENERAL VIEW OF A TEMPORARY PASTURE (FOUR YEARS OLD) ON FERN COUNTRY.
Mowing for hay.

poisoned, or at least rapidly lose condition. Fern poisoning is, however, rare when the number of stock employed in keeping down fern is considered.

The prevention of the fern getting beyond the curl stage is the essential feature of fern control. When once the frond expands it becomes far more difficult to break off than when in the curl stage, and if sheep are being used to crush the fern the land must be stocked heavily before any sign of uncurling of the leaf takes place. If cattle are used the fern can be successfully crushed at a little later stage than it can with sheep, and this is the main reason why cattle are often looked upon as more efficient fern-

crushers than are sheep on land suitable for cattle. I should always advise the employment of cattle, as then a delay of a few days in the first heavy stocking in the late spring does not matter much, although it is always better to get the beasts on the ground before any of the fern has reached beyond the curl stage. On many types of ground cattle-stocking is not practicable, and sheep must then be used.

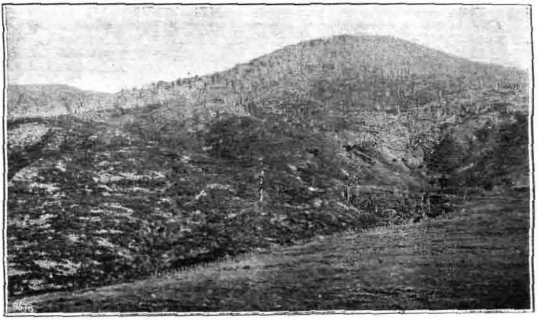
In crushing fern subdivision into comparatively small paddocks of not more than 50 to 100 acres greatly facilitates the process, and even smaller paddocks are desirable. The area annually broken in should never be so large as to necessitate insufficient fencing, on account of expense, as a small acreage thoroughly dealt with in the season following sowing is much more satisfactory than a larger area on which the fern is only partly kept in check. Every fern-frond that is allowed to expand only increases the difficulty of control, for by its activity in manufacturing food materials it restores vitality to the underground stems and renders them capable of producing fresh fronds. When stock are turned into an area ready for crushing, the quicker the land is cleaned up the better. As soon as they have eaten down or broken off by trampling all the young fronds the stock should be removed to another area and the process carried out there. It has been said that with sheep-crushing four days' stocking and eight days' resting of the paddocks should be carried out during the first season, but such an intensive treatment is not really necessary.

When once the first great growth of fern has been checked in the spring a considerable time often elapses before the next growth—developed from buds arising from the fronds previously eaten down—makes its appearance above ground. As soon as this occurs restocking has at once to be taken in hand and the operation repeated each time the fern reappears. If stocking is properly carried out the first season after sowing there should be very little difficulty experienced in the following years. Under no circumstances, however, should the fern be allowed to get away after the first season, and if this occurs the area may rapidly become fern-infested again. In paddocks where in the second or third season fern gets away in patches it should, if possible, be mown so as to force up fresh growth, and then be crushed out while the fern is young.

The crushing-out of fern, provided plenty of stock are available, presents no difficulties; but, unfortunately, in certain cases the conversion of fern-land is attempted without proper provision being made for an adequate supply of stock for crushing purposes during the initial crucial stages.

THE CONTROL OF INDUCED FERN.

The control of induced fern presents difficulties that are not so noticeable when breaking in natural fern country. Induced fern generally follows either an unsuccessful burn or else develops on bush-burn country where the grass mixture sown fails to permanently keep its hold on the land—that is, where a mixture not suitable for the district is used. On comparatively flat land induced fern should never become particularly troublesome, for the same methods as applied against natural fern can be carried out. But on steep, rugged country induced fern is often extremely bad,



BUSH-BURN COUNTRY (ON HILL) REVERTING INTO FERN.
Holding-paddock in foreground clear, owing to heavy stocking at intervals with sheep.

and when once well established is exceedingly difficult to eradicate. On hilly bush-burn country likely to turn into fern within a few years of sowing very particular attention has to be paid to the mixture used. Cocksfoot and rye-grass are generally the predominating seeds that are sown, and for some years the land may keep up a two-sheep standard. In a few years, however, the rye-grass disappears, and soil-creep occurring on the bare ground leaves the isolated cocksfoot plants raised above the general level, in which condition they are very liable to be actually pulled out by sheep. Fern then begins to appear, and, the carrying-capacity having dropped, sufficient stock cannot be maintained to keep it down. In a few years the fern attains the mastery, and frequent firing of the fern, followed by insufficient stocking, only makes its dominance

more pronounced. The farmer meanwhile has probably kept up his total number of stock by fresh bush-burns, which in turn finally become fern-clad.

Such a condition of affairs is, happily, not usual, but many areas can be seen that have been treated in this way. On this class of country I hold it to be better to grass with a mixture that is likely to produce permanent one-sheep grazing rather than virtually sacrifice the land for a few years' higher carrying-capacity by means of grasses that by themselves are not likely to remain permanent. I should advise the cutting-out of perennial rye-grass altogether and making a fairly liberal use of such grasses as *Poa pratensis*, Chewings fescue, crested dogstail, and *Danthonia*, with probably brown-top in the northern parts of the Dominion. Amongst these grasses *Poa pratensis* is one of the most important; it binds the association together well, gives excellent feed, and stops soil-creep —a very important consideration on steep hills.

A generalized mixture, somewhat as follows, should give good results on country where fern is likely to attain the mastery: Cocksfoot, 8 lb.; *Danthonia pilosa*, 5 lb.; *Poa pratensis*, 3 lb.; Chewings fescue, 5 lb.; crested dogstail, 2 lb.; *Poa nemoralis*, 2 lb.; white clover, 1 lb.; *Lotus angustissimus*, ½ lb.: total, 26½ lb. In addition, a few pounds of Italian rye-grass, to give an immediate bite, might with advantage be included.

The objection to a mixture of the above type is its expense, but this consideration should in no case determine the farmer to use a lower-priced but unsatisfactory sowing. In all cases the area of the bush-burn must be regulated so that an efficient—even if high-priced—mixture can be sown.

On induced-fern country that can be subdivided easily, and where the ground is not too hard for grass-seed to germinate, methods similar to those employed on natural fern country can be carried out. It is important, however, to let the fern develop a good growth before being fired. The burning each season of induced fern not followed by sowing is to be deplored, as in this way the chance of ever getting a good seed-bed is seriously reduced. Where it is found absolutely necessary to burn induced fern without previous subdivision an attempt should be made to turn the land into *Danthonia* country. After burning, a mixture somewhat after the following nature should be used: 8 lb. *Danthonia pilosa*, 8 lb. Yorkshire fog, and 3 lb. suckling-clover. Such a mixture, when even partly established, will survive periodical burning of the fern, and should later develop into exceedingly useful pasture.

On certain types of induced fern the utilization of pigs in the rooting-up and destroying of the underground stems has been applied

in many cases. Certainly the effect of pigs is often extremely satisfactory, but the main objection to this method is that only small areas can be dealt with, and the expense of fencing is very considerable.

CONCLUSION.

A consideration of the conversion of fern-land into grass shows clearly how whole-heartedly the farmer will attempt to control a serious weed provided practical and payable methods for its eradication are known. The control of fern has in most instances been shown to be highly remunerative, and no effort is spared to attain that end. How different it is with weeds whose control has not *yet been shown to be a profitable proposition!* Fern, although one

BUSH-BURN LAND REVERTED TO FERN, THEN BURNT AND SOWN, AND HEAVILY STOCKED AT DEFINITE INTERVALS.

Traces of the eaten fronds and fronds broken down are to be seen.

of the worst of our weeds, and in the control of which very large sums of money are annually expended, has not been deemed worthy of inclusion in the Noxious Weeds Act, nor would its inclusion be of any aid in its repression. The pioneer farmers of New Zealand showed that the control of fern under most conditions was both feasible and payable, and the average farmer stands in no need of compulsion in the conversion of fern into grass-land. In certain instances where fern is spreading seriously and its control is but half-heartedly carried out the main reason for the apparent apathy with regard to its eradication is because in such cases really payable methods of control have not yet been demonstrated.

PASTEURIZATION OF MILK FOR CHEESE-MAKING.

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SINCE the pasteurization of cream for buttermaking resulted in such a marked improvement in the quality of butter considerable interest has been taken in the possibility of applying similar treatment to milk used for cheesemaking. For some time this was considered almost impracticable, owing, firstly, to the very large quantities of milk to be dealt with in the limited time available for this purpose —in most factories from two to two and a half hours; and, secondly, to the high cost of heating such large quantities of milk by the methods adopted in butter-factories for dealing with cream.

The advent of the regenerative heaters now on the market has, however, completely overcome both the difficulties indicated. These machines are capable of treating up to 1,800 gallons of milk per hour, while heating to a temperature of from 165° to 170° F., and at the same time regenerating up to forty degrees. Thus, a duplicate plant of this capacity running for two and a half hours would in that time be capable of dealing with 9,000 gallons of milk — a capacity sufficient for practically any of the largest cheese-factories in the Dominion. Moreover, there appears to be no reason why the capacity of these machines could not be increased to, say, 2,000 gallons per hour.

A complete plant of 1,800-gallon capacity can be installed for £300. As few cheese-factories have yet carried on this pasteurizing-work for a complete season, no reliable figures are available regarding the cost of running. It is, of course, evident to any one conversant with the business of cheesemaking that heating the milk to a temperature of 165° must cause an increase in the amount of fuel consumed, but this increase is actually not nearly so great as would at first appear to be the case. When pasteurizing is carried out there is obviously no necessity to heat the milk in the vats, as is the case under the old system of cheesemaking. This latter method of heating is a most extravagant one, whereas the system of regenerative heating is as economical a one as it is possible to obtain, the heaters in use being so constructed that they utilize to the fullest possible extent every unit of heat applied.

From information at present available it would appear that the increase in fuel-consumption when pasteurizing with live steam is from 15 to 20 per cent. A saving, however, may be effected in this direction by having exhaust steam from the engine connected to the heater.

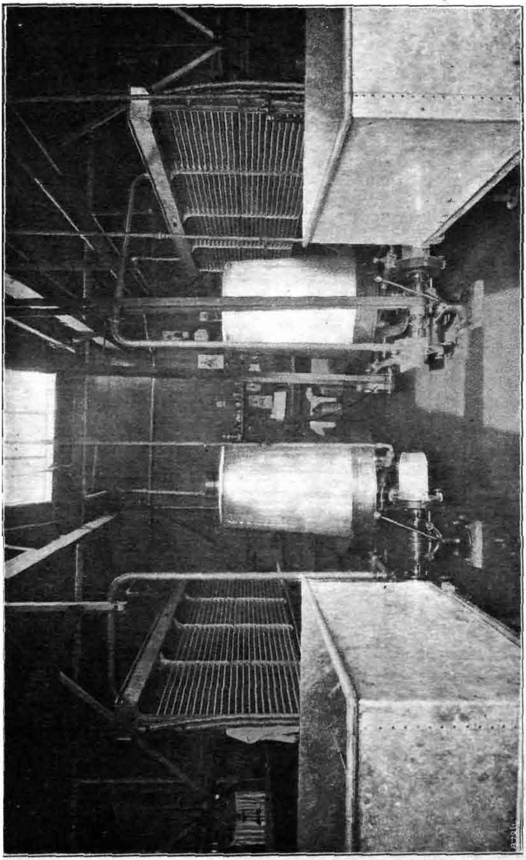
Some dairy companies contemplating the installation of a pasteurizing plant may be inclined to delay on account of the scarcity of water available for cooling purposes; but as the regenerative heater delivers the milk to the cooler at a temperature of 125°, and it requires only to be further cooled to setting-temperature—86° to 90°—it will be seen that no very great quantity of water is required. Where water is somewhat scarce a saving can be effected by installing a small pump, and pumping the waste water from the cooler to overhead tanks. This water is, of course, perfectly clean, though slightly warm.

In the manufacture of cheese from pasteurized milk practically the same treatment should be applied as in dealing with non-pasteurized milk under normal conditions. Extreme care must be taken to guard against the possibility of the milk becoming in any way contaminated during the process of pasteurization. Only the best-quality drawn brass piping should be used where piping is required. In order to facilitate cleaning, the piping should be joined by brass unions in fairly short lengths. Every part of the plant with which the milk comes in contact should be thoroughly cleaned as soon as possible after the machine is stopped.

A good starter is, of course, essential in either case; but in working with pasteurized milk, which is practically free from bacteria, the influence of the starter is naturally much more prominent. Consequently, in the manufacture of cheese from pasteurized milk only the best-quality starters should be used.

The best pasteurizing-temperature to aim at is from 160° to 168° F. In the very late autumn it will be found advisable to fix the maximum temperature at 160°. A temperature lower than 160° is not sufficient to destroy all the injurious germs, while, on the other hand, the curds obtained from milk heated to 175°–180° are always more or less broken, and, in addition, usually develop a slightly scorched flavour.

The use of a quantity of hydrochloric acid for acidulating the milk before adding the rennet has been tried in some cases; but, except when the milk was heated to high temperatures, practically no difference in the nature of the curds was observed. When heating the milk to temperatures of 175° or over, the addition of



TWIN PASTEURIZING PLANT AT PIHAMA CHEESE-FACTORY.

Showing whole apparatus—receiving-vats, milk-pumps, regenerative *heaters*, and *coolers*.

oz. to 1½ oz. of hydrochloric acid per 100 gallons of milk will ›e found to be an advantage.

There are many benefits to be derived from the pasteurization f milk for cheesemaking, chief of which is the great improvement ı the quality of the cheese. Some very striking instances of this ave been observed in Taranaki during the past season. One articular factory while working under the old method always roduced a large percentage of second-grade cheese, but since asteurization was adopted not a single second-grade cheese has een manufactured, and, in addition, the factory's average grade as risen from 89 points to 92.

Another important factor from the dairy-farmer's point of view ; whether or not the expenditure incurred in installing a pasteur-:ing plant is going to be a good investment. From information ow available there can be no doubt that the investment is an xcellent one.

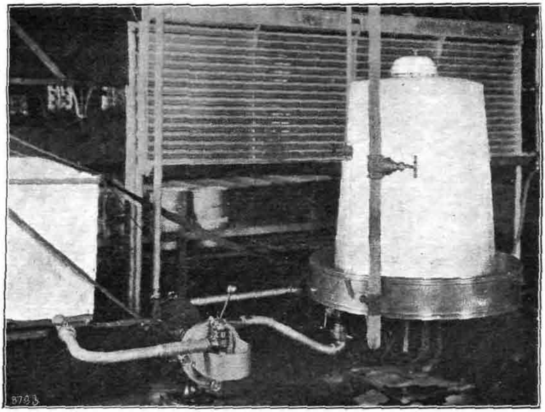
There are many ways in which the farmers' returns will be ıcreased with the assistance of a pasteurizing plant. To begin 'ith, "fast-working" vats, which are due to slightly overripe ıilk, are never experienced when pasteurizing is followed. All ıctory managers and directors are well aware of the enormous ›sses which take place while working with this class of milk, specially in a season such as the one just past, when the weather 'as for a long time exceptionally warm. The saving effected in his direction alone, by means of the pasteurizer, must be very ıaterial.

Again, we have the fact that there is a considerable increase ı the amount of butter-fat incorporated in cheese made from asteurized milk. This is proved by the small percentage of fat :ft in the whey, and also by the fact that no fat is found floating n the milk or in the cheese-presses. The presence of extra solids ı the cheese indicates, of course, that the moisture-content can e increased without injury to the body, thus producing a direct ıcrease in the amount of cheese made per pound of butter-fat ›ntained in the milk.

The improvement in the quality of the cheese also means a irect increased return to the dairy-farmer. By working with milk 'hich has been delivered to the factory in good condition and fterwards pasteurized, and by giving careful attention to the ıanufacture, second-grade cheese can be almost entirely eliminated. ıs practically all cheese sales are made on a basis of ¼d. per ound deduction for second-grade, the saving thus effected must lso be credited for the most part to the pasteurizer.

Taking all these factors and the saving thereby effected into consideration, it is perfectly safe to assume that the total increased return of a cheese-factory working with pasteurized milk will be equal to at least a 3-per-cent. increase in yield. On this basis a very simple calculation will show the amount of net profit, after allowing for interest and depreciation on plant, extra fuel required, and also a reduction of approximately 20 per cent. in the amount of butter manufactured from the fat in the whey.

Regarding the quality of the milk supplied, it would be a fatal mistake for the dairy-farmer to assume that the installation of a

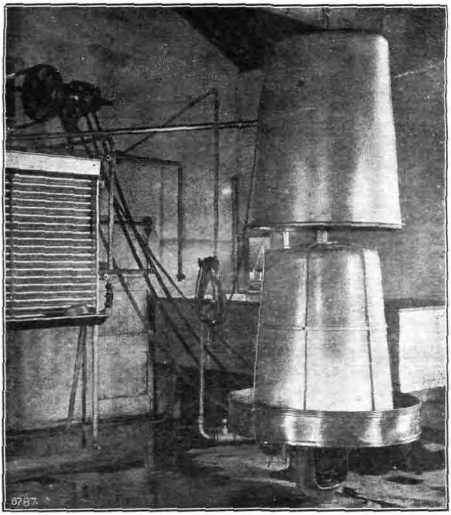


REGENERATIVE HEATER FITTED FOR USE OF EXHAUST STEAM.

pasteurizing plant at the factory in any way lessens his responsibilities with regard to the care of the milk on the farm. The quality of the milk supplied will always be the chief factor in determining the quality of the cheese made, whatever method of manufacture may be adopted. For instance, an experience in Taranaki during the past season with milk strongly tainted with turnip flavour proved conclusively that pasteurization would not entirely eliminate this flavour. The latter was easily detected in

the cheese, notwithstanding the fact that the milk had been heated to a temperature of 190°.

During the season 1914–15 seven pasteurizing plants were installed in cheese-factories in Taranaki, while at the present time thirty-two plants are in operation there. This large increase in the number of plants installed proves that the factory managers and directors in this district are fully convinced of the benefits



METHOD OF DISMANTLING REGENERATIVE HEATER FOR WASHING.

of pasteurization. From all the facts now available, it is quite evident that the pasteurization of milk for cheesemaking has been in all respects an unqualified success.

There is no doubt whatever that the general adoption of the system of pasteurization in the cheese-factories throughout the Dominion will cause as great a revolution in the manufacture of cheese as it has already effected in relation to butter.

CONTROL OF THE NEW ZEALAND FLAX GRUB.

PRELIMINARY OBSERVATIONS.

DAVID MILLER.*

JUDGING from observations made throughout the Dominion by the writer, the larval attacks of *Xanthorhoe praefectata* upon New Zealand flax (*Phormium tenax*) are most serious in the Makerua Swamp, on the left bank of the Manawatu River.

It has been asserted that the regularity or irregularity of floods causes respectively a decrease or increase of the grub; but it is found that *Xanthorhoe* is just as liable to seriously attack flax swamps which are very wet or subject to regular floods as areas that are perfectly dry. This is illustrated by the swamp at Otaitai Bush, in Southland, where four years ago, when the swamp was undrained and very wet, the larval attacks were very serious; while now, though the swamp is dry and well drained, the larvæ have practically disappeared. Again, in the Waikato the flax growing upon the river-bank and subjected to floods is more seriously attacked than the flax on the higher levels. The best example is the extensive swamp area in the vicinity of Te Puke (near Tauranga), where the flax grows not only at sea-level and along the banks of the Kaituna River, where the swamps are drained and dry, but also upon the terraces overlooking the river-flats, and consequently upon a variety of soils, such as clay, loam, and peat. Throughout the whole of this dry area the larvæ have not yet made an appearance. The hill flax of Southland is mostly free from *Xanthorhoe*, while, owing to the steepness of the ground, the country is well drained. This is also characteristic of many other swamp areas, such as those at Koputaroa (in the Manawatu), Otaika (near Whangarei), Hikutaia (near Te Aroha), &c. On the other hand, in the Makerua Swamp, which has of late been subject to few floods and has been well drained, the larval depredations have become extremely serious. Again, in the swamps at Kawakawa (Bay of Islands), which are low-lying and undrained and

* Mr. David Miller, well-known in the Dominion as an entomologist, was some months ago attached to the Biology Section of the Department for the purpose of conducting a complete investigation of the pests and diseases of New Zealand flax, especially with a view of devising methods of control of the grub *Xanthorhoe praefectata* in the interests of the flax-milling industry.—EDITOR.

subject to severe floods (there being no fall), *Xanthorhoe* is absent. After a flood these swamps are not only free from all insects, both winged and otherwise, but owing to the heaviness of the floods even the flax in parts is almost exterminated. The condition of the grub being absent from wet or flooded swamps is also seen at Gore, and two small areas in the vicinity of Te Aroha, and in a few other isolated cases. Although *Xanthorhoe* exists throughout New Zealand, its attacks on the flax are at present of no moment except in the Makerua Swamp.

With few exceptions it was observed that *Xanthorhoe* confined its attacks to those bushes around and within the roots of which was an accumulation of decaying leaves and other rubbish, which apparently afford a suitable shelter to the grub during the day. Also, as a rule, there were no attacks on those bushes free from rubbish at the roots and having the fans well separated at the base, the butts being exposed to the light. In most public and private gardens where phormium is grown rubbish is not allowed to accumulate at the base of the plant, and invariably in such cases the attacks were totally absent. However, in part of the Dunedin public gardens the flax-bushes have been neglected and rubbish has accumulated, in which case the attacks of the grub are well marked. If the larvæ be placed in the direct sunlight they become helpless. They are nocturnal in their habits, but have been noticed to commence feeding operations on dull and wet days. Temperature seems to affect their movements; practically few or no fresh attacks were noticed in the North Auckland districts, a few in the Manawatu, many at Waikanae, while great activity was observed in Southland, where the weather was very cold. It should be noted, however, that a month intervened between the observations of North Auckland and those in Southland, which last district was visited in April, about six weeks after the observations made in the Manawatu and at Waikanae.

The grub exists in districts where severe frosts occur—for example, in parts of Southland; while in other districts also subject to frost the grub does not exist—*e.g.*, on the margins of Lake Tutira, which has an elevation of about 800 ft. above sea-level. But the absence of the grub in this locality may be due to the presence of large numbers of swamp-hens and other native birds. The presence of birds may also cause the absence of the grub at Wairoa, where the flax grows at sea-level and is not subject to frosts which occur in the surrounding valleys.

The presence of birds (such as the swamp-hen) in the swamps probably plays an important part in keeping such pests as *Xanthorhoe* in check. I have noticed that in most of the Auckland, Hawke's

Bay, Wairarapa, and Southland flax areas, where the grub does no material damage and is in many places totally absent, the swamp-hen is present and in several cases very abundant. Also, where there are large flocks of starlings the grub is by no means serious. It is said that the grub became more apparent in the Makerua Swamp after the extermination of the swamp-hen. Though this may be one of the causes of the increase of *Xanthorhoe* in this district, it will probably be found that other changes in the environment have influenced the insect directly or indirectly.

It would prove invaluable to secure swamp-birds from various localities and dissect the crop in order to ascertain what forms their staple diet, and whether they are partial to *Xanthorhoe* when other foods exist, as it is well known that certain insects are unpalatable to birds. I have also observed several small brown lizards amongst the flax in those districts where no *Xanthorhoe* exists, and the same may apply to these animals as to birds. It would be a simple matter to confine two or three swamp-hens within an area of flax badly attacked by the grub, and keep them under close observation. A wire-netting fence would be suitable if the wings of the birds were cut. Lizards could be kept under observation within a much smaller area than the birds.

Live-stock would no doubt play an important part in freeing the swamps of undergrowth and rubbish. As already indicated, the larvæ, being nocturnal, doubtless require some such shelter as decaying leaves, &c., to protect them from the sun and daylight. In the Makerua no stock are run, but on the other side of the Manawatu River—the Moutoa—where the grub is not serious, there is a dense growth of grass, and stock are allowed access to the flax area. In many parts where the grub is not serious stock are allowed to graze upon the grass of the swamps. Such is the case in Auckland, Southland, Nelson, &c.; but at Wairoa and other large blocks, though the grub is practically absent, no stock are grazed, since the flax is so dense that beasts would be unable to move about without damaging the leaf.

If stock were employed it would be necessary to fence in each area as it is cut until the young flax had attained a sufficient growth not to be eaten by the animals. This would necessitate fencing off the newly cut areas, and for this reason I suggest that sheep would prove the most satisfactory in this case, as they are not so liable to inflict damage as cattle frequently do, chewing off the succulent parts of the leaves to about half their length and leaving the fibre stripped. Besides, the outlay on fencing for cattle would no doubt be prohibitive. It would also be necessary to know at what periods the stocking of the swamps

would be most likely to damage the pest, and consequently a thorough knowledge of the life-history of *Xanthorhoe* would be required.

In the Manawatu swamps the river, and to a less extent drains, form an impregnable barrier to the advance of the larvæ of *Xanthorhoe*, but of course would hardly check the distribution of the moth. The fact that two areas such as the Moutoa and Makerua, so closely placed—being only separated by a river—should differ so much as regards the attacks of the larvæ points to a probable local difference, such as a more palatable leaf in the Makerua than the leaf of the Moutoa. This might be caused by some latent element in the plant-food of the soil made available by the heavy draining of the Makerua—the peat sinking, becoming more compact and undergoing decomposition in contact with the atmosphere. The lack of this element may account for certain patches of the Makerua being almost free from the attacks of the larvæ, though surrounded by badly affected leaf.

Not only is the Moutoa Swamp free from serious grub-attacks, but also the other areas—the Lockwood Swamp—on the same side of the river. That the river should separate two classes of soil seems very probable; but none of the areas on the Moutoa side of the river have been so severely drained as the Makerua. Again, the heavy draining of the latter swamp, combined with the peculiarity of the soil, may present some favourable condition for the pupation of the insect, affording perhaps greater warmth and protection to the pupa. But the large flax areas in the Bay of Plenty have also been well drained, and the peaty portions have sunk considerably, as in the Makerua, yet *Xanthorhoe* is practically absent in the former locality. However, though the one condition may occur in both localities, they may differ in certain other features necessary for the increase of the insect. Or, again, in the Makerua the environment may have been so changed that some parasite or predaceous enemy has found the new conditions unfavourable.

It is apparent that *Xanthorhoe* does not abound on hill country except where some rubbish or decaying matter affords a suitable protection. But here, again, the succulent parts of the leaf may be found unpalatable to the larvæ, as it is well known that it takes less leaf of the hill flax to obtain a ton of fibre than is required for the same amount of the swamp flax, the former taking much longer to mature than the latter, and apparently having less edible tissue and more fibre.

Before any definite conclusions can be arrived at as regards pupation, it is necessary to know whether the insect pupates in

the ground, and, if so, at what depths; it would also be necessary to know where the female deposits the eggs, whether in sheltered or exposed conditions.

The extinction of a natural enemy, whether parasitic or predaceous, would release a very important check on the increase of *Xanthorhoe*, and if this be so it would be necessary to discover what was the enemy, and what the cause of its extinction—whether due directly to new conditions or indirectly through those conditions causing an increase of a secondary enemy preying upon the first; also what stage of the metamorphosis of *Xanthorhoe* is the most vulnerable, and if any stage is yet attacked by parasitic or predaceous enemies, or if each stage is liable to be attacked by its particular enemy. As the greatest mortality to insect-life occurs in the wingless stages—*i.e.*, egg, larva, and pupa—it would be most reasonable in this case to apply a check during these periods. However, by the use of birds a considerable decrease of the moths might be brought about if it were known the extent of their flight, and whether the moth be agile or sluggish, how far and high it is capable of flying, also whether it usually alights near the ground or otherwise, as it often is to be found with wings expanded on the flax-blades, its white colour rendering it conspicuous under these conditions.

The larval attacks of *Xanthorhoe* have been noticed upon other plants, such as bullrushes, and the absence within a particular area of an abundance of food plants other than flax would cause the larvæ to concentrate their attention upon the remaining available food material. I have been unable to ascertain whether the grub selects one or more varieties of flax in preference to all others, but, so far as has been observed, most varieties are liable to be attacked.

The insect fauna of the flax areas does not vary to any great extent throughout New Zealand, although I cannot definitely report on the insects of Southland, as the weather was extremely cold when the observations were made there. However, of the predaceous forms, the *Libellulidae* (dragon-flies) exist in large numbers in all areas of flax; but during the period of my visit (February–March) they were more abundant in the North Island than in the South (visited during April). It is curious that the *Asilidae* (robber-flies) abound in the Makerua Swamp, which in many places is very dry and the ground bare—their natural habitat. But across the river in the Moutoa Swamp, which is moister and carries a growth of grass, those *Diptera* do not exist. They may have some secondary bearing on the increase of *Xanthorhoe* in that they prey upon some other insect or insects which, before the advent of the

Asilidae, held *Xanthorhoe* in check, the new drier conditions of the swamp being more favourable to the *Asilidae* than formerly. These flies were not nearly so abundant, and were in most cases absent from the other swamps, both in the north and south. Another predaceous family, the *Therevidae*, with similar habits to the *Asilidae*, is represented in the Makerua but not in the Moutoa. It is evident that these predaceous insects do not prey upon *Xanthorhoe*, or at least to no marked extent—perhaps because the latter are nocturnal and the former diurnal—else the pest would not be so marked. The parasitic insects are also well represented throughout the flax areas, and some of these insects will require to be investigated.

In action taken to control *Xanthorhoe* it will probably be necessary to apply not only one method of checking, but a combination of methods, since the insect presents four different stages of development, each with its own peculiarities and, probably, enemies.

CERTIFICATE - OF - RECORD BULLS.

W. M. SINGLETON, Assistant Director, Dairy Division.

IN the last issue of the *Journal* comment was made on certain certificate-of-record bulls and the production of butter-fat by their C.O.R. daughters. The following notes refer to other certificated bulls that have attained an enviable reputation amongst dairy sires:—

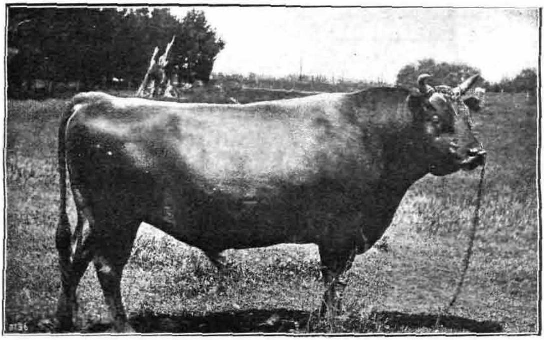
JERSEYS.

Starbright.—The bull Starbright was bred by Mr. J. A. McCrea, of Palmerston North, and first saw the light of day on 17th September, 1906. His sire, Starlight, was imported from Australia, and is the sire of Sabean III, which produced 625·38 lb. butter-fat in 365 days.

Eight of Starbright's C.O.R. daughters were bred by Mr. A. A. Ward, of Tariki, Taranaki, five of them being tested by him. Mr. Ward also tested, as mature cows, Psyche, with 531·24 lb. fat; Waif's Glory, with 522·19 lb. fat; and Michaelmas Day, which produced 480·87 lb. fat. Five of Starbright's C.O.R. daughters are from these dams, while another is inbred from a daughter of Michaelmas Day. With such foundation stock, Starbright had an excellent opportunity to "make good." That he has done so is a credit alike to himself and to Mr. Ward's original herd.

The record of Miro, a daughter of Starbright from Waif's Glory, has attracted considerable attention. She was the leader in the two-year-old class for a time, with a record of 548·69 lb. fat, which is almost double her standard of 276·20 lb. fat. Tuna, a half-sister of Miro's dam, and sired by Starbright, as a four-year-old produced 437·74 lb. fat. Waif's Frisky, a full sister of Tuna, qualified for a certificate by producing in 336 days 419·93 lb. fat in the class for three-year-olds, her standard being 309·30 lb. fat.

Starbright is the sire of three C.O.R. daughters from Michaelmas Day. The best of these records was made by Waitui, which produced 463·38 lb. fat as a three-year-old. Nellie, also as a three-year-old, has a certificate for 367·84 lb. fat in 349 days; and



STARBRIGHT.

Michaelmas Daisy, in the four-year-old class, produced 337·74 lb. fat in 302 days. Polly, a daughter of Starbright from his own daughter Waitui, produced 409·22 lb. fat as a two-year-old.

Only two other daughters of Starbright exceeded their requirement by as many pounds of fat as did Polly. One of these was Polly's dam, Waitui. So far as the record is an indication, the inbreeding evidenced by Polly's pedigree was not injudicious.

Two other daughters of this bull have also produced creditable records. Palm-tree, in the four-year-old class, has a credit for 411·70 lb. fat. Tui, whose dam is Psyche, referred to above, produced as a two-year-old 358·66 lb. fat in 320 days.

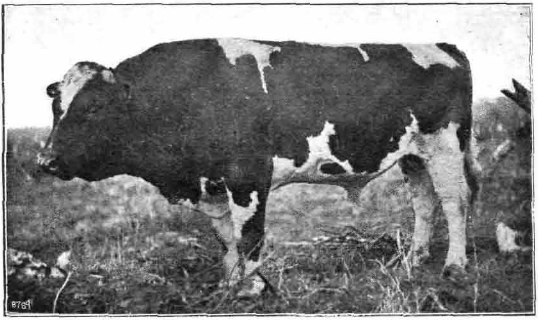
It will be noted from the foregoing remarks that the progeny of a number of these daughters of Starbright are backed by C.O.R.

figures for two generations, and that the strains indicated in a number of the pedigrees have been well proved as producing-lines.

FRIESIANS.

Colonel Manor of Riverside.—The name of the Friesian bull Colonel Manor of Riverside has been brought to the fore as the result of testing work done by Messrs. C. A. Hopping and J. Liggins. This bull was imported by Mr. C. Hopping, and is the sire of five certificate-of-record daughters, all of which were bred by Mr. Hopping.

The best record held by any one of this bull's daughters is that of Lady Mooie Blanco III of Ashlynn. She commenced her test at



COLONEL MANOR OF RIVERSIDE.

the age of 5 years 295 days, and in 321 days produced 15,022·40 lb. milk, containing 652·21 lb. fat. Doubtless this cow inherited some of her ability as a milker from her dam, which in 241 days produced 10,602·80 lb. milk and 401·43 lb. fat. Not only is Lady Mooie Blanco III a heavy producer of milk and butter-fat, but that she transmits her qualities to her offspring may be noted from her daughter's record as a three-year old, which stands at 14,671·70 lb. milk, containing 626·06 lb. fat, in 290 days.

Sunflower of Ashlynn, in the three-year-old class, produced a record which reflects credit on her sire, Colonel Manor of Riverside. In 251 days she gave 11,308·80 lb. milk, containing 498·30 lb. fat. Riverside Violet, another daughter of this bull, was tested by Mr. C. A. Hopping as a two-year-old. In 297 days she produced 11,762·20 lb. milk, containing 398·98 lb. fat.

Two of the daughters of this bull made their records on the farm of Mr. J. Liggins, Tokomaru. Each cow was in the mature class, and each did creditable work as a producer. Ashlea Daphne in 302 days has a production of 12,352·0 lb. milk, containing 463·36 lb. fat, while Ashlea Cissy in 286 days gave 10,457·50 lb. milk and 404·96 lb. fat. Both Ashlea Daphne and Ashlea Cissy represent a mingling of the American strain of the sire with a dam representing Mr. Grigg's breeding.

Paul Pietertje.—Paul Pietertje is a son of Sir de Kol Inka Pietertje, who has twelve certificate-of-record daughters. His sire and dam were both imported from North America by Mr. Newton King when he founded his purebred herd.

Paul Pietertje was purchased from Mr. King by Mr. J. Donald, who placed him at the head of his herd at Westmere, Wanganui. To daughters of this bull bred by Mr. Donald ten certificates have been awarded.

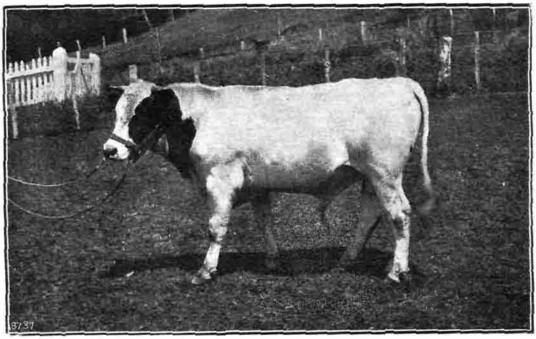
In the Westmere herd Paul Pietertje was mated with females of the strains imported from Holland by Mr. John Grigg, of Longbeach. A general survey of the C.O.R. testing results indicates that this system of breeding—*i.e.*, the mating of sires of North American descent with females of Dutch lineage—has frequently produced very satisfactory results, and in many instances the progeny have proved of outstanding excellence. It was by using Nazli de Kol, a full brother to Paul Pietertje, with foundation cows descended from Mr. Grigg's importations that Mr. G. Aitchison, of Kaitangata, got such splendid results.

Netherland Princess IV, the highest C.O.R. daughter of Paul Pietertje, is well known to those readers of the *Journal* who are interested in purebred dairy stock. Her production of 805·77 lb. butter-fat has been exceeded only once in Australasia, and then by an older cow in New Zealand. The dam of Netherland Princess IV was Netherland Princess, a daughter of Netherland Queen VII, which cow produced 659·31 lb. fat under our checking system, although no certificate has been granted. Two full sisters of Netherland Princess IV were bred and tested by Mr. Donald. Of these, Westmere Princess Pietertje gave the higher production. Commencing at 1 year 236 days of age, for 303 days she has a credit of 424·10 lb. butter-fat from 11,113·70 lb. milk. The other full sister, Princess Paul Pietertje, in the two-year-old class, produced in 280 days 10,388·60 lb. milk, containing 386·08 lb. fat.

All of Paul Pietertje's C.O.R. daughters were tested young. Westmere Duchess V commenced at the age of 1 year 304 days, and produced 13,724·80 lb. milk, containing 461·17 lb. fat. Caroline Paul started her first season at the age of 1 year 295 days, and

in 314 days produced 325·16 lb. fat. The succeeding season she commenced her record in the two-year-old class and raised her repeat certificate to 402·85 lb. fat.

Brookland Johanna Pietertje was sired by Paul Pietertje, her dam being a daughter of Netherland King, an illustration of which bull appeared in the May *Journal*. In the two-year-old class this daughter produced the creditable record of 417·17 lb. fat in 305 days. Another daughter of similar breeding to the foregoing is Netherland Duchess Pietertje. This young cow, in the three-year-old class, in 331 days produced 11,019·70 lb. milk, containing 383·82 lb. fat.



PAUL PIETERTJE.
Photographed when a two-year-old.

The last daughter of Paul Pietertje to qualify is Domino Queen. She is a granddaughter of Domino, imported by Mr. J. Grigg, and bears the same relationship to the imported cow as does Domino III, who, before the commencement of the C.O.R. testing, had a credit at the Weraroa Experimental Farm for 365 days of 21,264 lb. milk and 762·4 lb. fat. Domino Queen milked 334 days and produced 322·21 lb. fat as a junior two-year-old.

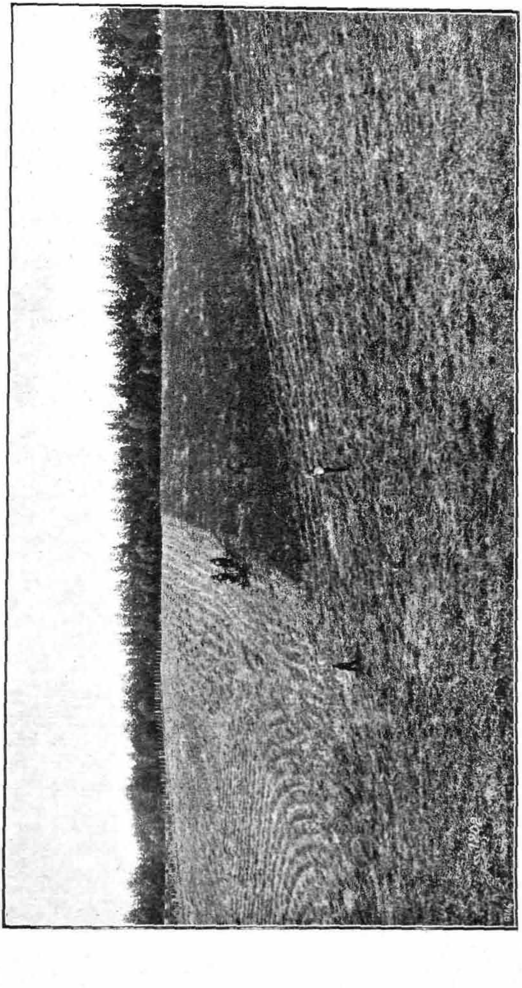
With the exception of Netherland Princess IV and Caroline Paul, all of these daughters of Paul Pietertje made their records during 1914–15. This was a particularly dry season at Westmere, and twice-per-day milking was followed much of the time. The productions are, therefore, more creditable than the abstract figures indicate.

LUCERNE-CULTURE.

A MOUMAHAKI FIELD.

AMONG the best-established and cleanest stands of lucerne in the Dominion is the area of some 15 acres at the Moumahaki Experimental Farm, known as Field No. 5. The accompanying photograph shows the field with the second cutting in progress last summer. The following particulars are supplied by Mr. T. W. Lonsdale, Manager of the Farm :—

The seed from which the lucerne crop was established was sown in November, 1913. The history of the field for the previous two years is, briefly, as follows: In 1911, following rape fed off with sheep, Algerian oats were sown, no manure being supplied with this crop. After harvesting the oats the stubble was disked, and a catch-crop of mustard, rape, buckwheat, and vetches was sown, the principal part of the crop being grazed and the residue ploughed under. Rye-corn was then sown, and manured with 3 cwt. of basic slag per acre. This crop was also grazed with ewes and lambs and the land again ploughed, and sown with swedes in December, 1912, 1 cwt. of basic slag, 1 cwt. Island phosphate, and 28 lb. muriate of potash per acre being applied with the seed. The swedes were carted off the land, after which vetches, $1\frac{1}{2}$ bushels, and barley, 1 bushel, per acre were sown in July, 1913. This crop was ploughed under early in October following, and immediately afterwards ground limestone, 15 cwt. per acre, was applied. The land was then worked down for lucerne, and a few days prior to sowing the seed 300 lb. per acre of soil taken from an established lucerne-field was applied and harrowed in. On the 14th November 13 lb. of lucerne-seed per acre was sown on a well-rolled surface, 4 cwt. basic slag and $\frac{1}{2}$ cwt. sulphate of potash per acre being applied at the same time. Over the major portion of the field three varieties of lucerne were sown — namely, Colonial (Marlborough), Hunter River, and Tamworth. The yields from these three have been even throughout, and very little difference is noticeable in any respect. A smaller section of the field sown with the Dryland variety has given less even results, and has been marked by an exceptionally long dormant period. The first cutting, a light one, was made on the 14th January, 1914, since when seven crops have been



CUTTING LUCERNE IN FIELD NO. 5, MOUMAHAKI EXPERIMENTAL FARM.

taken, and in addition the paddock has been twice grazed. The total yield, irrespective of grazing, has been 120 tons of hay, and approximately 200 tons of green material carted to stock or made into ensilage. Each autumn the field has received vigorous cultivation with the solid-tooth cultivator and tine harrows, and is free from weeds.

LUCERNE AT BURNHAM.

Lucerne trials which present several special points of interest are those which have been carried out at the Industrial School, Burnham, on what is probably one of the most shingly portions of the Canterbury Plains. The Manager of the school, Mr. T. Archey, has supplied the following report to the Department's Fields Instructor for the South Island, Mr. A. Macpherson, with whose co-operation the test was initiated :—

The lucerne-seed you sent me in 1911 was sown in November of that year in drills 9 in. apart : The area of the test was 1 acre, which was divided into four plots, as follows : Plot No. 1 was sown with seed only ; plot No. 2 was sown with seed and inoculated soil ; plot No. 3 was sown with seed and lime only ; plot No. 4 was sown with seed, lime, and inoculated soil.

The first cutting for produce took place early in April, 1912, with the following results : Plot No. 1, 1,100 lb. ; plot No. 2, 1,500 lb. ; plot No. 3, 1,900 lb. ; plot No. 4, 2,300 lb. (green weights throughout).

The land was kept clean and worked constantly. Cutting took place four times, and the total yield from the four plots was 12 tons.

For the following season the land was well cultivated, limed (½ ton to the acre), and heavily dressed with mixed stable and farmyard manure and cleanings from Addington railway-sidings. Crops were cut four times, and the yield for 1913 and 1914 respectively was 15 tons.

The year 1914 to 1915 was very dry, and, notwithstanding the labour and fertilizer, the yield was poor. The crop was cut with total result of 6 tons.

For 1915 to 1916 I heavily manured with home-made fertilizer, made up as follows : (1) 1 cwt. powdered fowl-droppings, 1 cwt. dried gorse or wood ashes, 2 cwt. sieved soil from the shingle-pit ; (2) 1 cwt. cow-dung plus wood-ashes and soil ; (3) 1 cwt. sheep-droppings (powdered) plus wood-ashes and sieved soil ; (4) 1 cwt. pig-dung plus ashes and soil. The whole of the fertilizer passed through ⅛ in. sieve. In many instances I added 10 lb. to 15 lb. calcined bonedust. On this acre I applied 25 cwt. of these various fertilizers and irrigated the plot. The crop has had five main cuttings this season, with a final light cut early in May, making a total yield of rather over 13 tons.

As a forage crop I think lucerne unequalled.

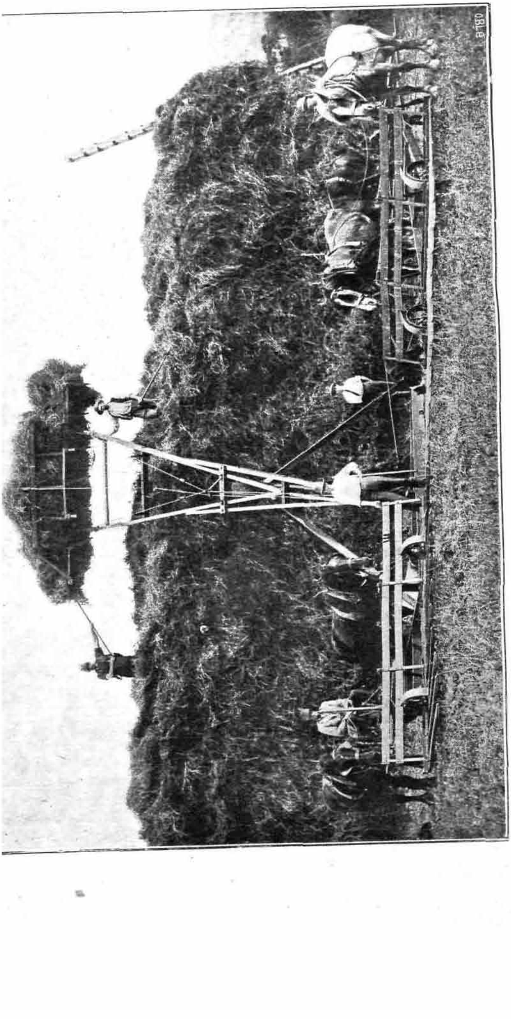
Commenting on this report Mr. Macpherson makes the following remarks :—

The manuring of this plot, like that of many others in the South Island, cannot be considered a success. The yield for 1914–15 would no doubt have been quite 15 tons had no manure been applied, and would have continued similarly during 1915–16. It will be noted that the crop for 1914–15, after the application of manure, was poor, and also that the past season's yield was not up to that of the best years. It is much to be desired that definite tests be conducted on lucerne plots as to whether fertilizers should be used or not after the crop has been established. Past experience appears to indicate that a well-established lucerne-field is better left alone, manuring only encouraging the growth of weeds and grasses on the surface, which is injurious to the lucerne-growth; whereas the lucerne feeds not from the surface but far down into the subsoil and below.

LUCERNE MANAGEMENT IN POVERTY BAY.

Mr. A. G. Faulkner, of Wairakaia, Gisborne, a successful lucerne-grower, forwards the photograph of lucerne-stacking operations reproduced on the following page, together with the following note :—

When once a lucerne-paddock is established (which in Poverty Bay is usually in the first year) it is very little harder to work than the ordinary clover or rye-grass paddock. The farmers one meets who think lucerne is only of value to the small dairy-farmer, if they only put in a couple of acres would realize what a valuable thing lucerne is. The number of sheep lucerne will carry per acre is greater than most readers of the *Journal* would believe. Cattle grazed do well on lucerne, and with an efficient stacking plant four or five men and a boy can stack from 14 tons to 16 tons of hay per day. In saving lucerne hay it is absolutely essential to have a swath-turner, as it is necessary to dry and stack the hay as quickly as possible after cutting. Lucerne and prairie-grass I find very satisfactory, but it is better to get lucerne well established before sowing the prairie-grass. In the second or third year we run the disk harrows over the paddock as often as necessary, and sow not over a bushel of prairie per acre. One often hears it said that lucerne will not carry stock in the winter-time. This, I should say, depends greatly on climate and locality. Here, where frosts are very slight, a 6-acre paddock last winter carried seven dairy cows and ten hoggets for the four winter months, and the stock always had more than they could eat.



STACKING LUCERNE ON MR. AND MRS. A. G. FAULKNER'S WAIRAKAIA FARM, NEAR GISBORNE.

Stack 16 ft. high, 50 ft. long, and 20 ft. wide. Nine hours' work with patent stacking plant. Only two forks used.

LUCERNE-GROWING IN THE "SEVENTIES."

Mr. A. Macpherson, *Fields Instructor, Christchurch*, writes :—

It may be of interest to many to know that the New Zealand and Australian Land Company, who were the pioneers of many of the improved methods of farming and did so much for the advancement of agricultural and pastoral pursuits in New Zealand, grew lucerne over forty years ago on their big Levels Estate, in South Canterbury (since subdivided for closer settlement), also on their Clydevale Estate in Otago. The following is from Mr. R. Irving, farmer, of Albury, who at that time was overseer on the Levels Estate :—

In 1875 we had over 100 acres in lucerne on the Levels Estate. It was sown in rows 15 in. apart and seeded at the rate of 15 lb. per acre, which we found to be plenty of seed. Attention was paid after each cutting to give intercultivation. This was done by taking the mould-board off the single-furrow plough, leaving only the share on it, and running this between the rows. Afterwards we used to tine-harrow it. It was a great success, and we usually cut a crop from three to four times during the season. As a hay crop it was unrivalled; all farm animals were fond of it. It was stocked with sheep some two or three years after it was sown, but it never did well after that.

THE GRASS-PEA.

A. McTAGGART, M.S.A., Agriculturist.

THE valuable type of legume called the grass-pea has been grown, particularly for fodder purposes, fairly extensively in parts of Ontario, and local experience gained since its recent introduction to New Zealand (upon the recommendation of the writer) bears out the good name the plant has in Canada.

The grain of the grass-pea is dark yellow in colour, angular in shape, and small. The plant is a fine-leaved edition of the field-pea, though more decumbent, and to some extent it resembles the vetch-plant. It requires a fair amount of warmth, not too much moisture, and a fairly good soil.

The crop may be grown either alone or with oats, rye, or barley for soiling (green-feed producing) purposes. It is highly palatable to stock, is easily grown, makes an excellent cover-crop in orchards, makes good hay, is a fair yielder of grain valuable for feeding (crushed) to various classes of farm animals, and is an excellent soil-renovating crop.

GRASS-PEA—PART OF PLOT AT MOUMAHAKI EXPERIMENTAL FARM.

At the *Ontario Agricultural* College, Guelph, an average of 30 bushels per acre of grain of the grass-pea has been obtained over a series of years. At the same institution in 1909 various leguminous crops yielded per acre green fodder as follows: Harbara soy beans, 9·2 tons; grass-peas, 8·0 tons; Amherst soy beans, 7·6 tons; Shingto soy beans, 7·5 tons; Cloud soy beans, 7·4 tons; hairy vetches, 6·8 tons; Isurunoko soy beans, 6·5 tons; Chernie soy beans, 6·1 tons; and Nuttall soy beans, 6·1 tons.

Over a period of five years ending in 1909, of six varieties of leguminous crops grown at Guelph for green fodder the following gave the greatest yield: Grass-peas, 6·9 tons per acre; Ito San soy beans, 6·8 tons; Early Yellow soy beans, 5·5 tons; and Wonderful cow-peas, 5·2 tons.

For a period of ten years ending in 1910, of four varieties grown in succession for that period at Guelph for the production of green fodder the following average results were obtained: Hairy vetches, 7·4 tons per acre; grass-peas, 7·2 tons; Early Yellow soy beans, 6·9 tons; Wonderful cow-peas, 5·2 tons.

From the above it will be readily seen that the grass-pea, in common with the hairy vetch, is a decidedly desirable crop to grow for soiling purposes. The tests at Moumahaki have fully justified the importation of the grass-pea, and it should prove an acquisition to the dairy-farmer and to the fruitgrower, just as the hairy vetch is a decided boon to the fruit-farmer, particularly, in Canada. But this can only eventuate when steps are taken to raise sufficient seed, and to sell it at a price satisfactory to the farmer and orchardist.

Mr. J. Beverley, Assistant Plant-breeder, supplies the following particulars regarding the tests with the grass-pea at the Moumahaki Experimental Farm during the past season:—

The tests were made with the seed harvested at Moumahaki in April of last year. Following a crop of early potatoes, seed was sown broadcast at the rate of 1 bushel per acre on the 3rd November, 1915. The crop was cut with a scythe on the 6th January last to facilitate the operation of digging in, while an adjoining plot of hairy vetch has not produced sufficient bulk to make the scythe necessary. A later trial of the pea was made with a similar seeding on the 12th January on a plot of 160 square yards. The illustration shows part of this crop on the 19th May still in flower and vigorous, with a little seed forming. Approximately the grass-pea weighs 5·3 oz. per 1,000 seeds, and it should be sown in October or November if a seed crop is desired.

VETERINARY NOTES FOR HORSE-OWNERS.

E. L. SIDDALL, M.R.C.V.S.

THE following notes deal briefly with three horse troubles—strangles, nasal catarrh, and influenza—against which farmers, and horse-owners generally, do well to be on guard, more especially at the present time of year as regards the two last-named complaints.

STRANGLES.

This very infectious disease is only found in horses. It is generally seen in young animals, but may attack horses of any age, rarely affecting the same horse twice. Strangles is caused by a germ which is found practically all over the world.

The symptoms are as follows: The animal is first noticed to be dull and off its feed, with a discharge from one or both nostrils. This discharge, which is at first thin and watery, after a few days becomes thick and sticky. Soreness of the throat is generally present; this is shown by the horse having some difficulty in swallowing. The chief symptom is the formation of an abscess in connection with the glands situated between the branches of the lower jaw. This abscess commences as a small hard swelling, which gradually becomes larger and is always very tender. As the swelling increases in size it also becomes softer, until it is ripe. This is shown by a falling-off of the hair at one part, accompanied by a slight sweating at the same point. At this time the abscess is ready to be opened with a sharp, clean knife, taking care to make a good-sized opening.

For treatment, it is advisable to let the animal have a run at grass in a well-sheltered paddock, provided the weather is favourable. The throat should have one dressing with a sweating-blister, in order to hasten the ripening of the abscess; this dressing should be applied from the base of the ears, down both sides of the throat, between the jaws, and a little distance down the throat.

Where medicinal treatment is necessary, 2 drams of extract of belladonna together with 2 oz. of chlorate of potash should be made into a soft paste with 4 oz. each of treacle and sugar, and a piece the size of a walnut smeared on the tongue twice daily.

If the horse is kept in the stable the bowels must be regulated by giving soft feed, such as bran mashes and scalded linseed.

The most important point in curing a case of strangles is to keep the abscess well open until all the discharge has stopped, because if it is allowed to close up too soon the abscess will re-form

There is one rather severe form of strangles, in which the abscess does not form, but the animal has soreness and tenderness of the throat, which is shown by flinching when pressed in the region of the larynx or "voice-box"; the head is extended, and there is difficulty in swallowing water, which may return through the nostrils accompanied by particles of grass, &c. Generally in these cases there is a roaring noise made in the breathing, which is often laboured in the advanced stages. Such cases are best treated by a mild blister rubbed in for eight minutes—after clipping off the hair—from the base of one ear, down round the throat, between the jaws, and up to the base of the other ear.

NASAL CATARRH.

This is the name given to an inflammation of the membrane lining the nose and air-passages of the head.

The symptoms commence by sneezing, with a dryness and redness of the membranes of the nose; this is followed by a thin discharge, which afterwards becomes thick and yellow. In the later stages there is generally a cough and slight fever, which is shown by the patient looking very dull, shivering, and having a rough coat.

For treatment, if the cough is troublesome the throat should be rubbed with a liniment made of equal parts of ammonia, turpentine, and olive-oil. Two drams of extract of belladonna and 2 drams of camphor should be mixed into a paste with linseedmeal and treacle, 40 oz. of each, and a small quantity smeared on the tongue twice daily.

INFLUENZA.

This suddenly occurring complaint is often noticed after wet seasons, and is always accompanied by great weakness.

The symptoms are indicated by the suddenness of the attack, together with great weakness and depression, and a high fever noticed at the very commencement of the attack. There is, as a rule, swelling of the eyelids and a profuse discharge of tears. The patient generally has a cough, and this is usually accompanied by some soreness of the throat; in some cases there is difficulty in breathing.

As treatment, the diet should at first be laxative and cooling, but as soon as the animal begins to recover every attention must be paid to keeping up its strength. Three times daily give the following drench: Carbonate of ammonia, 2 drams; nitre, 1 dram; cold gruel, 1 pint. This is to be continued for three or four days, or until the symptoms become lessened.

If owing to the soreness of the throat the drench cannot be administered, give an electuary made by mixing up 2 drams of

chlorate of potash and 1 dram of nitre with linseed-meal and treacle and smear on the tongue twice daily.

Relief is sometimes given by applying a mixture of flour and mustard in equal parts, made into a thin paste with cold water to the sides of the chest, and covering with newspaper before putting the cover on the patient.

It is most essential that every precaution be taken to prevent the spread of infection in this complaint, as its dissemination is more than rapid if once allowed to get the upper hand.

PIGS AND GRASS-GRUB CONTROL.

THE dry seasons experienced in many parts of the Dominion have been very favourable for the increase of the grass-grub, and extensive damage has been done to pasture and grain crops by the pest. Various methods have been suggested to assist in the control of the grub, but they generally involve the cultivation of the infested area. This is expensive and not always satisfactory, and it frequently happens that on small farms (dairy farms in particular) it is not convenient to break up a field.

A South Taranaki farmer, Mr. Johns, has to a great extent solved the difficulty, and has successfully treated several infested paddocks. His method is to ring his store pigs, and then turn them on to the infested field about the month of May. The pigs being rung, will turn up only the patches of grass that have been cut by the grub. As the pigs root up the grass numbers of grubs are eaten by them, and they are greatly assisted by large numbers of birds, chiefly starlings and minahs. After the pigs and birds have passed to a fresh patch a careful examination of the patch they have just left will reveal scarcely a grub, so well has their work been done. When the pigs have gone thoroughly over a paddock and rooted up all the infested areas Mr. Johns resows the patches, rakes as much as possible of the old pasture back on to them, and gives them a good rolling.

I recently examined a paddock treated in this way last winter and at the time of my visit (April) the previously infested areas were the bright spots of the pasture, being covered with a splendid sole of rye-grass and clover. Where conditions as to surface-sowing &c., are suitable, farmers troubled with the grub may be confidently recommended to give Mr. Johns's method a trial. Although autumn is probably the best time for the operation, it might also be carried out in spring.—*J. W. Deem, Fields Supervisor.*

PLANT-SELECTION AND QUICK PROPAGATION.

THE following record of a grass selection at Moumahaki Experimental Farm is presented as an encouragement to those interested in the improvement of farm crops to carry out similar work, also as showing how quickly a selection of the class described can be propagated when correct methods are used.

ITALIAN RYE-GRASS AT MOUMAHAKI, PROPAGATED BY DIVISION FROM A SINGLE PLANT, IN NINE MONTHS AND A HALF.
Height of sheaves, 30 in.

On 24th March, 1915, the writer's attention was attracted to a plant of Italian rye-grass in the field forage-crop tests at Moumahaki, owing to it not having run to seed like its neighbours and on account of its freedom from rust. The plant was lifted, and eighteen divisions were made from it and planted out. On 7th June the eighteen plants were lifted and 183 plants made by further

division, these being given about 1 square foot each in the plot to allow of a hoe being used for cultivation. In order to delay seeding until a good roothold had been established the plants were cut on 21st October, the weight of the cutting being 68 lb. The plants then made strong fresh growth, pollination took place between 12th and 14th December, and the plot was harvested on 5th January, 1916, yielding 6 lb. of seed — approximately 1½ million seeds. Some of this seed was plot-tested during the past autumn and made a vigorous, heavy growth. The illustration shows the sheaves from which the seed was threshed in January.—*J. Beverley, Assistant Plant-breeder.*

POULTRY-FEEDING WITHOUT WHEAT.

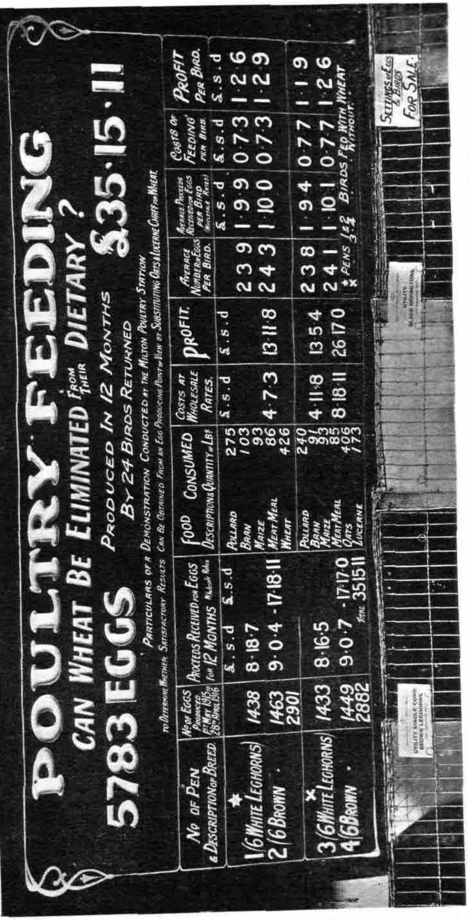
NOTES ON THE MILTON TEST.

F. C. BROWN, Chief Poultry Instructor.

THE feeding test recently concluded at the Department's Milton Poultry-station, final results of which were published in last month's *Journal*, has brought out several useful facts. The most important of these demonstrates what was really the sole object of the test—namely, that a satisfactory egg-yield can be secured where wheat is totally eliminated from the ration. It has also been shown conclusively that lucerne is a most valuable constituent of a fowl's diet. As oats were also used with the lucerne, the favourable results obtained from a diet from which wheat was eliminated cannot, of course, be attributed to the lucerne entirely.

The morning mash during the test for pens Nos. 1 and 2 (birds fed with wheat) consisted of 2½ parts pollard, 1 part bran, 1 part maizemeal, with 5 per cent. meatmeal added. In both rations the proportion of pollard had at times to be slightly varied according to its quality. The whole was moistened with hot water, and the birds were given as much as they could eat without waste. The evening meal consisted of whole wheat, and was fed in straw litter.

The morning mash for pens Nos. 3 and 4 (birds fed without wheat) was prepared and fed on similar lines to that of pens Nos. 1 and 2. In this case, however, the lucerne-hay chaff was placed in a bucket with boiling water overnight, covered with a sack and allowed to steam in its own heat. This process had the



THE MILTON FEEDING TEST DEMONSTRATED IN THE DEPARTMENT'S WINTER SHOW EXHIBIT, 1916.

effect of making it swell, practically doubling its bulk. The moisture contained in it, together with any liquid that was not taken up, usually provided sufficient moisture for bringing the mixture to a right consistency. The amount of lucerne used was varied according to the birds' appreciation of this food. When it was found that the lucerne was being left in the trough and the ground grains eaten, the indication was taken that the birds were getting too much of the lucerne, and the proportion was reduced for a time. It may be mentioned that, apart from the amount of meat-meal mixed in the mash in both cases, it was supplied in a separate receptacle and left always before the birds, thus giving them an opportunity of balancing their own ration. When there was no grass in the pens green feed (chiefly turnips) was fed during the day, while gravel-grit, crushed oyster-shell, and also clean water were always before the birds. The oats used in connection with the test were Sparrowbills of a good plump quality.

The test has also demonstrated that nothing less than the yearly record can be taken in regard to a bird's laying-capacity. This is proved by comparing the results put up by the individual pens for the first twenty-four weeks of the test with the yields for the full year, as shown in the following table :—

	Totals for First 24 Weeks.	Totals for 52 Weeks.
Pen No. 1	778 eggs	1,438 eggs.
Pen No. 2	610 ,,	1,463 ,,
Pen No. 3	742 ,,	1,433 ,,
Pen No. 4	602 ,,	1,449 ,,

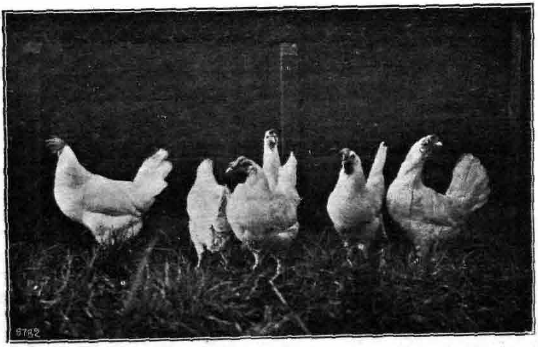
The most striking comparison is in regard to pens Nos. 1 and 2. It will be seen that during the first period pen No. 1 led pen No. 2 by 168 eggs, whereas for the fifty-two weeks pen No. 2 not only caught up pen No. 1, but beat it by twenty-five eggs.

It will be noted that twelve White Leghorn and twelve Brown Leghorn pullets took part in the test, one pen of each breed having wheat in the ration and the others having none. By using one pen of each breed of the same age and strain, and supplying a different ration respectively, it was considered that the results obtained would be more conclusive than would be the case if only single pens of the same breed were used. The birds were selected as evenly as possible, both in regard to laying type and points indicative of constitution, while breed-points were not overlooked, the whole of the birds being good specimens of the breeds they represented. The

even laying returns produced by the individual breeds, as well as the individual pens, clearly indicate that there is a special laying type, and that a bird's laying-capacity can to a great measure be determined by any one possessing the natural eye for form.

The test has demonstrated in a striking manner that the Brown Leghorn when bred from an egg-producing viewpoint is a highly profitable breed to keep, and that it is well adapted to the southern climatic conditions. The two pens of this breed laid a greater number of eggs than the White Leghorns, and No. 2 pen returned the highest profit over the cost of production. It may be mentioned that this particular strain of Brown Leghorns is the result of crossing at Milton some six years ago an American standard male with English standard females. From that time the flock has been bred and selected on egg-producing lines, while combining the points that go to make up an English standard Brown Leghorn. The birds now conform in a great degree to Ludlow's plates in Lewis Wright's "Book of Poultry," being smaller and more active than the majority of Brown Leghorns to be seen in the classes at the poultry shows in New Zealand.

The accompanying photographic reproduction of a table compiled to present the test in a compact form at the Department's winter-show exhibit will enable the above comments to be followed. Other tabular matter concerning the test has been printed in previous issues of the *Journal*.



ONE OF THE PENS IN THE MILTON FEEDING TEST.

WORK FOR THE COMING MONTH.

NEW ZEALAND *is a country of wide variation in climatic and soil conditions. In applying suggested procedure it is, therefore, necessary for the farmer to amend it to suit local weather-conditions and the requirements of his soil—information which can best be ascertained by a study of these problems on the part of the farmer himself. Nothing can take the place of local knowledge. Little advice on an agricultural subject is capable of general application in its entirety.*

THE FARM.

CULTIVATION.

As a rule July is one of the wettest months of the year, and very little in the way of cultivation can be attempted on the arable farm. Up to the time of writing in June, however, the rainfall in most districts has not been so heavy as to really saturate the land. A thorough soaking followed by good hard frosts would, in fact, be an all-round benefit, and should such conditions ensue farmers would be well content to keep the teams off the land during July. If, however, conditions are favourable for work, the ploughing of lea for green or root crops—or, in districts of good rainfall, for spring cereals—may go on. It is too late now to break lea for cereal crops in the drier districts. Towards the end of the month the sowing of spring cereals, particularly oats, may be commenced; but, except from the point of view of having work well forward, there is no advantage to be derived from July sowings. On the contrary, heavier seeding is necessary, and, except on light land, much of the seed may fail to germinate.

FIELD-PEAS.

One of the most suitable crops for sowing from July onward is field-peas. This is a crop which in recent years has become very popular for fattening in parts of Australia where dry weather, aphis, and other troubles make rape altogether too uncertain. A similar state of affairs, unfortunately, is all too common in New Zealand also, and it is a point worth considering whether it would not be worth while to try field-peas on part of the rape break.

The advantages of this crop will not be exhausted by the fat stock turned off it, for the good effects of peas on succeeding crops and on grass are invariably most marked. As a grain crop in suitable localities peas usually pay well. They are not a crop, however, which will stand feeding off at any stage and afterwards produce a seed crop. Peas are a crop which no pig-raiser should neglect; and by getting them in as early as possible there will be more time available to devote to other pig crops, such as rape, mangels, pumpkins, &c., which will be due for sowing in the following months.

LIMING AND MANURING.

It is opportune to press the urgency of top-dressing pastures. Probably the most general need in this direction is for applications of lime. Free-working soils in the drier plain areas may fail to give any appreciable response to limings, but on all cold, heavy land there is hardly room to doubt that applications of lime would increase the value of the land many times the cost of the application. The soundest advice that can be given this month to farmers so situated is to get a supply of lime by hook or by crook, and see to its application as soon as possible. All things considered, ground limestone is the best form in which to apply lime, and an application of even 10 cwt. per acre will seldom fail to work wonders. Probably the greatest benefit would be derived from liming by applying from 10 cwt. to 1 ton on grass just before breaking up for rape or turnips. As the plough-furrow is deepened in subsequent cultivation by turning over the rape or turnip break, the lime becomes thoroughly distributed through the soil; and if a further similar dressing is then applied on the surface and harrowed in before sowing grass-seeds there should result a pasture which would gladden the heart of any farmer, whether his mainstay be cows or sheep.

While the importance of lime is stressed, let it not be thought that it is the one thing needful to remedy inferior crops or sickly grass. Phosphates are needed — superphosphates after liming, or, if liming has not been done, basic superphosphate, rock phosphate, Ephos phosphate, or phosphatic guano. None of these, however, will produce their greatest effect if applied to a soil lacking in lime.

With regard to the paddocks to be treated, those that are to be closed up later on for hay should not be neglected. Hay costs much less per ton to produce when it is the product of a heavy crop. Therefore lime and manure now, graze lightly during the

next month or two, and close up early, if you would get good cheap hay. Calf-paddocks certainly require to be dressed with lime, and in this case, for obvious reasons, preferably with ground burnt lime.

SEASONAL PREPARATIONS.

The lambing season and the beginning of the milking season are close upon us, and common-sense suggests that suitable pastures should be cleared of stock, thoroughly harrowed, and allowed to freshen for the purpose of starting off cows or lambs, as the case may be, in good style.

CARE OF DAIRY STOCK.

Amongst dairy herds some extra attention is advisable as the calving season becomes more imminent. Particularly is this the case with heifers coming to their first calving. It is unfortunate that with a definite milking season the dairy-farmer is often compelled to choose between the least of two evils—mating heifers at a rather immature age, or retaining them as heifers for an extended unprofitable period, during which they are liable to develop beef tendencies, and perhaps eventually to prove barren. The former course is the one invariably adopted, and every effort should be made to minimize the evil of early breeding by good treatment prior and subsequent to parturition. This cannot be too strongly emphasized. Roots and good clover hay, at any rate, should be forthcoming during July on all but the best pastures; and where roots and hay are not available the grass should be supplemented by an allowance of good oaten chaff.

This recommendation does not arise out of any theoretical consideration of the nutrition of dairy stock. It is a statement of fact that such treatment will pay handsomely in higher yields and better progeny. It has been proved by careful experiment that condition at calving-time in true milking-strains is essential for satisfactory production during the milking season. In the case of mature cows, however, especially with those which are deep milkers, high condition before parturition is well known to be conducive to milk-fever. The customary preventive of this trouble — 1 lb. Epsom salts and 2 oz. ginger in a drench, given about a week before calving—should not be neglected in such cases.

Injudicious feeding of roots and green fodder to dairy cows during the winter and early spring is the cause of considerable losses annually. At this period large numbers of the animals are in an

advanced state of pregnancy, and thus especially liable to dietetic disorders. Most of these feeding troubles can be avoided by ordinary care in management. The safest and most economic method of feeding such crops to dairy cows is to cart them on to clean pastures and feed regular rations in conjunction with a liberal ration of dry feed—the dry feed first and always.

Cows that have run on close pasture during the night and are then given an unlimited supply of roots or green feed on practically empty stomachs will invariably gorge, with more or less bad results. But if given a half to three-quarters of an hour on hay first, this will not only take the sharp edge off the appetite and prevent gorging, but will also supply at the proper time the bulk necessary to allow the digestive system to deal with the other food to the best advantage.

Fresh-pulled mangels are dangerous at all times, and particularly so in the late winter and early spring when they are sprouting. While pitting or clamping improves any kind of roots, it is most essential in the case of mangels, which undergo chemical changes for a period after pulling, making them not only much safer to feed, but also improving their food value to an appreciable degree. When they have not been stored in the desirable manner they should at least be pulled and allowed to lie in the weather for ten days before feeding.

In the spring, when the pasture provides ample feed of the best and safest variety, dairy cows are in many cases used as scavengers by being shut into cultivation paddocks to clean up the surplus roots at a time when the latter are generally, at the best, in a dangerous condition for feeding. Every year numbers of farmers pay dearly for learning that this practice is false economy, and that it is better management to waste the surplus roots than to lose good cows in full profit.

When dairy cows are grazed on turnips or green fodder they should have access to the pasture and a plentiful supply of dry feed. They should also not be permitted to eat out the roots below the surface of the ground. During wet, cold weather, when the danger of loss from digestive troubles and premature parturition is greatest, cows should be shut off the roots, and the latter carted on to the pasture.

HORSES.

As the foaling season draws near, draywork and heavy chain work should be abandoned for in-foal mares. Every care should be taken to get teams into good fettle for the heavy work of spring; sore shoulders must have special attention.

THE ORCHARD.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

ONE of the most important periods of the orchardist's year is now at hand. The majority of orchardists realize this and act accordingly, but there are still a large number, both commercial and private growers, who wholly fail to appreciate, or at least to take anything like full advantage of, the opportunities afforded them by the dormant season of putting their orchards into the order in which they should be.

Such growers no doubt recognize that they have a certain amount of routine work to do at this season, such as spraying, pruning, and cultivation, but at the same time ignore or fail to appreciate the connection which exists between the manner in which they do this work and its effect upon both their trees and crop the following season.

It is not sufficient to prune a tree simply because this is the pruning season, or because it is the custom of every fruitgrower—or, I should say, *nearly* every fruitgrower, as some do not prune at all—to cut more or less wood out of his trees during the winter-time. Pruning is a necessary and scientific work, but its benefits apply mainly according to the amount of intelligence exercised when the work is being performed.

Before commencing to prune a tree the whole scheme of things in regard to the tree should be clearly conceived—whether it be growth or shape that is required; inducing the tree to bear fruit; promoting growth in a tree stunted through overbearing or otherwise; improving the quality of the fruit, if necessary, by lessening the quantity it is likely to bear; and by considering the number of other matters which intelligent pruning is calculated to correct. After this has been satisfactorily determined every cut should be made with a definite object, and that object should be to correct all objectionable features and to bring about those which are desirable for the future benefit of both the tree and the crop in the shortest possible time.

The same applies to the control of orchard diseases. It is not sufficient to spray simply because there are diseases in the orchard, even though a popular spray is used, without first making sure that it is the right one for the particular disease in question. There are many sprays recommended for winter use at different strengths for the different pests and diseases, and unless some intelligence is exercised mistakes such as have been frequently made in the past will occur, resulting in the waste of time and material and subse-

quent damage to the tree from the unchecked disease. In spraying, as in pruning, the objects aimed at should be clearly understood; the right materials should be selected and carefully mixed, and applied at the correct strength, at the right time, and at a pressure sufficient to do the work thoroughly.

The same considerations apply to cultivation. Cultivation is not intended simply to hide weeds and rubbish and to make the orchard look pretty. The objects of cultivation, briefly stated, are to break up and aerate the soil, and to provide fresh plant-food and moisture for the tree to feed upon. This alone demands that the work should be thoroughly done.

DRAINAGE.

This is a matter of the greatest importance to the health of an orchard. Many fruit-trees fail to thrive mainly owing to bad drainage. A thorough drainage scheme should be carried out before the trees are planted at all, but where this has not been done, or where additional drains are found to be required, they should be laid with as little delay as possible. Although existing drains should have been attended to earlier than this, it is better to be late than never. All open drains should be cleaned out, and broken or defective pipes in others renewed. Low-lying, badly drained parts of the orchard, easily discernible now, should be attended to straight away.

SPRAYING.

Where not previously attended to the following pests will require attention: Mussel scale, San Jose scale, brown, black, and red scale, &c., woolly aphis, mealy bug, and red mite.

Emulsified oil is the standard remedy for the whole of the above-mentioned sucking-insects, but the strength at which it should be applied varies slightly according to the class of tree affected. Pip-fruits require and will stand a stronger mixture without injury than stone-fruits, while citrus fruits require a still weaker mixture than stone-fruits. Moreover, some of the pests themselves succumb to a weaker spray than others. Mussel scale and red mite require a stronger mixture than San Jose scale or the other scales. Woolly aphis and mealy bug are about equal. With these more depends upon the force and thoroughness of the application than on the strength of the spray used. The best plan in spraying for the control of these insects is to base the strength of the spray upon that required to destroy the hardiest insect found affecting the tree.

July is the popular month for the application of oil sprays, excepting where two applications are being made for woolly aphis,

as referred to in last month's notes, in which case the first application is made as early as possible and the second toward the end of August.

The strength of the oil spray recommended for the control of the diseases mentioned is as follows:—

Mussel scale: Pip-fruits, 1–12; stone-fruits, 1–15 to 1–17.

San Jose scale: Pip and stone fruits, 1–15 to 1–17; citrus fruits, 1–20 to 1–25.

Woolly aphis and mealy bug: 1–15.

Red mite: Pip-fruits, 1–12 to 1–15; stone-fruits, 1–15 to 1–17.

UNRELIABLE ADVERTISING AND PACKING.

At the recent Patriotic National Apple Show held in Wellington Town Hall a case of apples was placed on exhibition by the Department of Agriculture bearing the following inscription: "Supplied direct from the orchard as 'A' grade Sturmers—Such unreliability disgusts buyers and kills trade." This case of fruit was forwarded to the Department by a buyer who bought it direct from the grower on account of an advertisement in the newspapers by a well-known orchardist, advising the public, among other things, to buy direct from the orchard if they wished to secure a reliable article less the middleman's charges. This matter is mentioned here with the object of warning growers who are engaged in this class of trade of the danger to their business which must follow unreliable advertising and packing. The fruit referred to, marked "A" grade, were small, badly spray-scorched, deformed, measly rubbish, scarcely fit to be termed "C" grade.

THE APIARY.

E. A. EARP, Apiary Instructor.

MOVING BEES.

If it is desired to move the hives to a new location the work should be carried out at the present season while the bees are dormant. Great losses are caused by beekeepers postponing moving until the spring. It is well to remember that in our climate, from one end of the Dominion to the other, the dormant condition lasts but a very short time, and full advantage should be taken of it, more especially when the bees are transferred only a short distance. In the latter case there will be an inevitable loss of bees unless

the weather-conditions are absolutely wintry. The risk in moving bees longer distances is not of course as great, because when they are moved from their old landmarks they will not desert their hives until they have taken an inventory of their new surroundings. However, in this there is another danger to be feared—namely, that by overheating the colonies a condition known as "scalded brood" may be produced, and result in the destruction of thousands of embryo bees. The wise beekeeper will therefore invariably choose the depth of winter for moving his bees either long or short distances.

DRY MATS.

During the winter months it is well to examine the mats at intervals in order to note their condition, more especially after heavy rain. Where mats are damp they should be removed and dry ones substituted. A supply of dry mats should always be kept on hand. In order to leave the colony undisturbed, carefully lift one end of the cover and examine the mat. If it has to be removed, see that the smoker is ready in case the bees are troublesome, but on no account use smoke unless the bees have to be driven down. Remove the wet mat as quickly as possible, replace it with the dry one, and cover the hive at once.

LEAKY COVERS.

If the mats are wet there must be a reason for it, in which case look to the covers. It is surprising how little attention is paid to covers. It is such a simple matter to make roofs waterproof that there is no excuse for any beekeeper exposing his bees to the danger of dampness in winter. More bees are lost through neglect in this direction than from any other cause during the cold weather, with the exception perhaps of actual starvation. Bees must be kept dry. Where the roofs are cracked do not attempt to tinker with them, but cover them entirely with some good waterproof material. Zinc or galvanized iron is the ideal covering, and some up-to-date beekeepers use sheet lead, the latter serving the double purpose of keeping the roofs dry, whilst its additional weight resists the onslaught of winter gales. However, if cost is a consideration, the thinner makes of rubberoid will serve the purpose admirably, and last for years with careful treatment.

PERMANENT SHELTER.

This is the season when it is most evident to the observant beekeeper that bees require plenty of shelter from high winds. The planting of shelter-hedges to protect the apiary should now be taken

in hand. Experience proves that bees in sheltered positions thrive far better than those in exposed situations. If the hives are protected the bees can take exercise every sunny day during the winter months, and this exercise is very essential to their well-being, as it is only in flight that bees can properly rid themselves of their excreta. Where sufficient shelter is not provided numbers of bees are lost through being beaten down by cold winds and rendered unable to return to their hives. Apart from the benefit to the bees, the beekeeper will find his work much more congenial when he himself is protected by permanent shelter. Shelter-hedges should be grown to a height of 8 ft. and no higher, and this will afford ample shelter for a large apiary. Of the many quick-growing hedges giant privet and tagasaste are perhaps the best. These trees have been tested throughout the Dominion with good results. In the South yellow barberry holds pride of place as a hedge for beekeepers, because, in addition to affording ample shelter, it yields an abundance of pollen and nectar in the early spring. Whatever trees are used, plant with the idea of forming a thick hedge, and do not set out to form a plantation. If tagasaste or giant privet are planted, see that they are protected from stock.

LIQUEFYING GRANULATED HONEY.

That honeys granulate and become solid in a certain time is well known to most beekeepers. This phenomenon has given rise to much speculation among consumers as to purity, and consequently producers of pat honey have had to educate the public, who formerly were suspicious that granulated honey was mixed with sugar. The crystallization of honey may be taken as a test for purity. Practically all the honey produced in the Dominion granulates, and the beekeeper may find it necessary to liquefy his honey when bottling. Many beekeepers are unable to procure small vessels in the extracting season, or their time is so much taken up attending to the bees that the honey is run off into larger vessels for the time being. Where the work of putting up the honey in retail packages has been postponed it may now be done. Liquefying is an important part of the producer's work, and must be carried out with great care, as neglect in this direction will lead to a poor article being put on the market and an injury to his trade. It must be understood that honeys brought to high temperatures become darker in colour and lose their flavour; besides, the higher alcohols which give honey its aroma are driven off. When honey is heated to 170° to 180° F. and over, decomposition of certain sugars sets in, and as a result an inferior article is produced. Such honey is

often seen for sale on the local markets, and is certain to deter the average person from eating honey altogether.

On no account should honey be liquefied by the direct application of heat, and it is extremely important that the temperature should not exceed 140° F. If it is necessary to liquefy bulk honey, this may be done by immersing the vessel in water which is brought gradually to 150°. At this temperature the honey will melt. Clover honey readily liquefies at about 140°. The process of liquefaction cannot be hurried, and if the mass of honey does not melt quickly, then it must be allowed to remain in the water from three to four hours. On no account apply greater heat. Too much stress cannot be placed on this point, as on it depends future sales and repeat orders. An ordinary washing-boiler is an excellent vessel to use where granulated honey is to be melted, but be sure that the tins are firmly soldered before immersing them. In order that the containers may not come in contact with the boiler it is advisable to place one or two small boards on the bottom of the copper. Place the tin to be heated on the boards, and exercise care in filling the boiler with water. When this has been done heat may be gently applied until the mass is dissolved. Liquefying honey is a tedious process at the best of times, but if good results are to be obtained the necessary amount of time must be spent on the operation.

THE POULTRY-RUN.

F. C. BROWN, Chief Poultry Instructor.

THE BREEDING-PENS.

No time should now be lost in mating up the breeding-pens, especially with the heavier breeds. True, there is time enough yet before commencing hatching operations as regards both the heavy and light breeds, but it is always advisable to have the birds mated well ahead, so that they may be well settled down before the eggs are required for hatching purposes. It will generally be found that August is the best month to hatch out the dual-purpose birds, such as Orpingtons, Rocks, and Wyandottes, and a month later for Leghorns, Minorcas, &c. It should always be remembered that it is more profitable to have the young stock brought out on the early rather than on the late side. Besides being more difficult to rear, the late-hatched birds seldom grow to the desired size. They

rarely develop into desirable breeding-stock, and as a rule lay smaller eggs and are more susceptible to disease than birds hatched at the right time. There are no chicks that do so well as those that are brought out just after the days commence to lengthen, and are well developed before the hot, trying summer-weather conditions prevail.

Great care should be exercised in selecting the breeders. The first essential is to have purebred stock, good specimens of the breed they represent, combined with laying type and the maximum points indicative of constitution. Of course, constitutional points must be given first consideration, for unless a bird possesses a strong constitution it cannot be expected that its offspring will have the necessary stamina to last out a long heavy-laying season, nor the same power of resistance to ward off disease. Now that it is proved and recognized that there is a special laying type the whole object of the breeder should be as far as possible to breed a uniform flock conforming to the correct type. It is true that fowls that have no special type or points indicative of purity of breed will at times produce good records. There are exceptions to every rule, but this does not disprove that in selecting the breeding-bird a definite type should be aimed at. A crossbred bird may have proved a prolific producer, but, not possessing the necessary fixity of type, she cannot transmit her laying-qualities with any degree of certainty. It may be said that like produces like, but this only applies where the parents are absolutely pure. One great weakness in utility poultry stock to-day is the great variation of type in individual breeds. Even in the egg-laying competitions few pens even of the popular White Leghorns conform to the same type, while it is also exceptional to find six birds in one pen uniform in this respect. It is well known with all classes of live-stock that to maintain purity of breed and to intensify desirable characteristics only purebred stock must be used for breeding. Many a common practice, such as treating phenomenal egg-records as the chief qualification of the breeding-pen, selecting on the pelvic-bone test, crossing the different breeds, or, in fact, anything which means the ignoring of breed characteristics, is certain to have a disastrous effect on the poultry stock of the country.

It is gratifying to notice that utility poultrymen are taking a greater interest in the poultry shows of the Dominion. These shows are practically the only means we have of preserving in a state of purity the many useful and beautiful breeds of poultry that are at our command. One of the greatest mistakes made in the past was to assume that because a bird was built on utility

lines it could not be a good specimen of the breed it represented. At the present time at most poultry shows of the Dominion there are separate classes provided for fancy and utility stock respectively, which means that the birds are judged on different standards. Now that fanciers and utility breeders have come to a much better understanding, with the common recognition of the fact that poultry can possess utility qualities and yet be desirable types of their respective breeds, it is to be hoped that in the near future the poultry shows will fall into line with the shows of other classes of live-stock—securing the adoption of one main class for each breed, judged on one standard, with the objective of combining beauty and utility in one bird. In order to become familiar with the various breed types of poultry, the novice cannot do better than study closely Ludlow's plates, together with the text describing their characteristics, in Lewis Wright's great work, "The Book of Poultry."

Having purebred stock and, if possible, a knowledge of their ancestry in regard to egg-laying performance, the first essential to be looked for in the ideal breeder is points indicative of constitution, such as a clean face free from wrinkles and feathers, bold, bright eye, short, stout beak, legs set wide apart, short shank, and tight feathering. These points only indicate constitution, and must be combined with points suggestive of laying-power, such as a deep and full abdomen of fine texture, a short keel, and an oblong body, full at crop and tapering from thighs to head, forming a wedge-like appearance. Summed up, and embodying both the above sides, the ideal breeding-bird should have a well-set-on head, a clean face free from wrinkles, a bold eye and medium-sized comb, be tightly feathered, have a fine texture of skin, have an oblong body on legs of medium thickness, the shank being short and the bone flat, set wide apart, well-developed crop, deep and full abdomen (which should be soft to the touch), and width across the back—a wedge-shaped appearance being thus presented from the top and side viewpoints. Generally speaking, the descriptive points outlined above apply to both male and female, apart, of course, from the usual sex differences. The male, however, should possess strong masucline characteristics by being stouter and more cobby than the female. The hen should be feminine in all respects. The feminine-looking male or the masculine female should never be bred from.

A serious weakness that is becoming far too common in many of the present-day utility stock is the lack of crop-development: that is to say, there is not sufficient width or depth from the point of

the shoulder downwards. A full crop in the breeding-bird is imperative, for birds deficient in this respect have not the capacity to hold the food necessary to produce the maximum egg-yield. Apart from this, breeding from stock with narrow brea ts always has the tendency the weaken the lung-capacity and constitutional vigour. In both sexes the crop should be well rounded and stand out prominently in front of the wattles. As to size, it is always advisable to choose for the breeding-pen the hen of a slightly larger size than that of the ideal layer, for it is easier to lose in weight of stock than to increase it. A proportion of small birds will always come to vex the breeder, even when the large ones are bred from.

MANAGEMENT OF BREEDING-PENS.

The number of hens to one male depends entirely on the amount of range and the vigour of the male. On a free range good results may be obtained with one male to twenty or even thirty hens, but the number of hens must be considerably reduced when the space is confined. In the latter case six to eight of the heavy breeds, such as Orpingtons, Wyandottes, and Rocks, and ten to twelve of the lighter breeds, such as Leghorns and Minorcas, will be the maximum for the best results.

It cannot be too strongly emphasized that birds in a breeding-pen—which, by the way, should always be in a dry situation—must have good exercise. If the run is not large there should be ample litter provided in order to induce them to take exercise. Unless the birds are kept thoroughly fit, vigorous progeny cannot be expected.

The feeding of the breeding-birds is all-important. Solid food is essential. The best of grain only should be used, and the contents of the morning mash should not be of a forcing nature. Good fertility and stock can be obtained from the feeding of grain to the breeders night and morning, the grain being given in a manner that induces the maximum amount of exercise—that is, in deep litter. It is a mistake to provide too large a proportion of animal or other forcing food. At such a time birds cannot be oversupplied with green stuff, while ample fresh water and grit are details which must not be neglected. One big advantage in feeding grain in the litter is that overfatness is not induced in the hens.

MARKING DUCKLINGS.

A correspondent asks if there is any way of marking ducks without the use of leg-bands. The best method of producing a dis-

tinguishing mark for the determination of age, strain, &c., is to take a V-shaped piece out of the edge of the web of the foot. This should be done with a very sharp penknife, the foot of the duckling being held on a piece of solid board during the operation. Disappointment will generally result from using the ordinary chicken-marker for ducklings. The holes will invariably close up, though apparently obliterated marks may often be distinguished by holding the duck's foot in the line of light.

DUCKLINGS DEAD IN SHELL.

Another correspondent wants to know the cause of a large percentage of ducklings dying in the shell during incubation. This trouble is generally due to insufficient moisture, or not applying it in a proper manner; while sometimes the condition of the breeding-stock may be responsible. The best system of applying moisture to duck-eggs is to spray water at a temperature of 103° on them every morning after the fourteenth day (with the mouth will serve the purpose). Do this after the eggs have been turned, and immediately place them back in the machine. Never cool after spraying. Spray in the morning and cool at night. Care must be taken that the ventilation vents are open, so that any excess of moisture can get away.

THINGS TO REMEMBER.

Learning how to prevent poultry diseases is of greater importance than learning how to cure them.

The first essential in preventing disease is selecting breeding-stock possessed of a sound constitution.

In planning out a poultry plant every provision should be made for saving of labour.

There is much to be lost and nothing to be gained by the practice of underfeeding the laying-hen.

It is always a wise policy to have on hand a reserve male for the breeding-pen.

Dirty and draughty houses, stale runs, and low feeding are an invitation to disease.

Avoid crosses as much as possible, and breed with purebred birds on each side when it is possible to do so.

Forcing the breeders for egg-production is generally followed by poor fertility of eggs, bad hatches, and loss of chickens at the brooder stage.

THE FARM GARDEN.

W. H. TAYLOR, Manager, Arataki Horticultural Station.

VEGETABLE-CULTURE.

JULY is practically the first month of spring in many parts, so far as garden-work is concerned. Local conditions vary so much in various places that it is impossible to state a date that will be suitable for all. Local knowledge must be the guide. It may be taken as an axiom that spring sowing and planting should commence as soon as the soil and other circumstances are suitable. An early start is an advantage, but not unless all conditions are right, for crops that hang fire, so to speak, seldom do well. With the proviso mentioned spring operations may commence, including the planting of cabbages, cauliflowers, lettuces, and onions from the autumn sowing; also the sowing of carrot, lettuce, onion, cabbage, cauliflower, radish, mustard and cress, and cucumbers for growing in frames or houses. Peas are now to be sown in any place, and continued fortnightly sowings should be made. Parsnips may be sown if required early, but on the whole it is better to leave these till later. Plant garlic, shallots, and chives. Turnips must not be sown till August. Rhubarb may now be planted. Fuller seasonal directions respecting the above-mentioned vegetables may be found in the *Journal* for June of last year.

ASPARAGUS-CULTURE.

The preparatory steps which are necessary for the successful cultivation of asparagus must depend on the local conditions. It is a very strong-growing plant, and very deep-rooting. Only those who have had the unpleasant task of destroying a good bed of asparagus can form any idea of what a strong plant it is. It follows that unless the soil is in a condition to permit of deep rooting the plant cannot do really well; but, considering what a long-lived plant it is, and comparing the results to be attained, the labour involved in the preparation of the soil is, after all, not a great matter.

There may, however, be practically no preparation required. If the soil is a deep alluvial deposit, and, as is usual in such cases, the subsoil is sand and gravel, no trenching will be needed. It is neither necessary nor is it advisable in such cases to trench manure in deeply; it will wash down with rain. The soil being free, the roots can get down to find moisture and other food. If the subsoil is of any other character trenching is necessary, and

the deeper the better—no one is likely to trench too deep. It is useless to trench unless something is put between every layer to keep the soil open. Stable or farmyard manure is the best possible material to use, and the quantity should be liberal; it cannot be overdone; though it is possible to give more than is actually necessary, the overplus would not be in any way prejudicial to the plants. For keeping heavy soil open any or all of the following materials are useful: Burnt clay, road-sand, sea or river sand, remains of rubbish-fires, vegetable mould of any kind, old mortar rubbish from buildings, turf from the top of pastures. Sea-sand with broken shells in it should be avoided, or at least it should not be used in the top spit, as the sharp shell cuts the young grass.

The most suitable soil for asparagus is fairly strong loam overlying gravel. The same class of loam on clay is perhaps as good, but would require effectual drainage. Lighter soil would be equally good if in a place naturally moist. The class of soil first described is best for most places.

It may be as well to say here that plantations of asparagus are often made for commercial purposes on quite different lines to those outlined above. The land in such cases is prepared by the plough only; the beds are of an ephemeral character, and do not come within the scope of this article, which refers to smaller operations and private gardens.

It was formerly the practice to plant asparagus on raised beds. The practice has been so generally abandoned that it does not seem to me advisable to describe that method of planting. The plants are now put out on the flat, a method that is better than raised beds, inasmuch as it gives the roots a wider and freer run. Before proceeding to plant the ultimate aim should be determined. There are three things to choose between—namely, good heads of ordinary type, giant heads, and giant heads blanched. Blanched heads are secured by a covering of soil. These are most appreciated on the Continent of Europe, and are required by canning-factories. Heads are made green by allowing them to make their growth in the air clear of the soil; the lower portion of such heads are blanched. Green heads are said to have more flavour than white, and are preferred by most British people.

Good heads are grown by planting in rows 30 in. apart, the plants being 15 in. asunder in the rows. Giant heads are secured by planting at greater distances apart—rows 4 ft. apart, plants at least 3 ft. asunder. The distances last mentioned may appear extravagant, but this is not really so in the end. After a few years the plants will practically fill the space, the roots become

very strong and the heads correspondingly large. Blanched heads are secured by moulding up the rows in the two last-mentioned beds.

Beds may be established either by sowing seeds in a nurse-bed the year before planting, to secure the necessary plants; by purchasing plants to save a year; or by sowing seed where the plants are to grow. The latter method would involve some extra labour in tending the young plants during the first season, but would be more expeditious than raising plants to be transplanted, as the transplanting checks the plants to some extent. Lacking plants, the wisest plan would be to purchase them.

Planting should be done in spring just as the plants are beginning to grow. It is dangerous to plant before the roots are active; there is naturally some damage to the roots in lifting, and if the plants remain dormant long after planting the damaged roots are likely to die back.

To plant, throw out a trench with a long-handled shovel. The trench should be about 6 in. deep. Along the bottom of the trench rake up a little ridge 3 in. high. Set the plants on the ridge as on a saddle, with the roots outspread on each side; then throw in the soil. This method is for beds treated in either way described. When planting be sure to press the soil down very firmly on the roots before completely covering them with the soil. The crowns should be covered to a depth of about 3 in. If long blanched heads are required the rows should be 4 ft. apart, as blanching is done by throwing a ridge of soil from the intervals over the rows of plants. The ridges are broken down in winter before pruning is done, and thrown up again before growth begins in spring. Though planting will not be done for some months, it is important that the soil be prepared well in advance, so that it may settle down and be in good working-order for planting.

Stable manure is the most valuable fertilizer or plant-food, and should be used as freely as possible. Bonedust is a valuable and lasting fertilizer; apply 2 lb. per rod at the same time as stable manure is applied—that is, when preparing the soil for new beds or immediately after cutting down an established bed. After growth has well started give a dressing of common salt—2 lb. per rod—or the same quantity of sulphate of ammonia, or 1 lb. of nitrate of soda. The same may be repeated some weeks later during showery weather.

No heads should be cut till the third year from planting. Cutting heads from an established bed continues for about ten weeks. After that everything that grows should be left to mature, as the next crop will be in proportion to the amount of growth so matured.

THE FLOWER-GARDEN.

Planting of all descriptions of trees and shrubs, also the division and planting of herbaceous plants, may now be done. All the primrose family may be planted; old clumps are the better for being broken up and planted as separate crowns. Violas may be divided in a similar manner. Seedlings of every description of hardy plants that have been raised under glass may, after the necessary hardening-off, be planted out. Seedling pansies should be put out in rich ground; planted at this time they usually give the best flowers of the season.

Perhaps the most important work in the flower-garden at this season is rose-pruning. This subject was fully dealt with in the *Journal* for the same period last year. Briefly put, whatever class the rose belongs to, all worn wood should be cut out, also thin twiggy wood and immature growth. Hybrid perpetuals and hybrid teas should be pruned to form a bush with an open centre, and the branches should not be crowded. Leading branches should be shortened according to strength, usually to about 6 in., leaving a few inches more in the case of strong growers. Shorten side shoots to two or three buds.

Climbing-roses of most classes are best treated by a frequent renewal of the main rods. The long, gross rods that they are accustomed to make should be laid in almost entire, merely removing the immature tips. These rods will throw out sprays of flowers from every joint. The following season the resulting shoots, or laterals as they are termed, should be spurred back to two buds, and every shoot should flower. The next winter these rods should be cut out.

Wicheriana roses, of which Dorothy Perkins is one, should be thinned out, and the laterals shortened back somewhat. This work is best done at the end of summer, but it may be carried out now.

EGYPTIAN PHOSPHATE-DEPOSITS.

THE Department has received a communication from Mr. W. E. Kingsford, a business man of Cairo, and president of the British Chamber of Commerce in that city, regarding phosphate-deposits in Egypt. Mr. Kingsford submits the following propositions to the Department: (1) To act as its buying and shipping agent for whatever phosphates are obtainable from companies now working mines; (2) to take up on its behalf a prospecting license, with eventual lease of mine approved; (3) to negotiate on its behalf with existing licensees a working arrangement for taking over their rights in a mine not yet worked owing to lack of capital. Mr. Kingsford has been informed that the Government does not at present propose to take any steps in the matter, as it is considered more a question for private than for Government enterprise; but that publicity will be given to his proposals for the information of any person or association in New Zealand who might be interested in the matter of phosphate-supplies from abroad.

ONE OF THE POSTER DIAGRAMS IN THE DEPARTMENT'S WINTER SHOW EXHIBIT, 1916.

ANSWERS TO CORRESPONDENTS.

IN every instance a question to which an answer is desired in these columns must be accompanied by the full name and the postal address of the inquirer, not necessarily for publication, but as a guarantee of good faith. The question *should be written on one side of the paper only.*

SALTING DOWN BUTTER.

"AVOCA," Streamlands :—

Would you be good enough to inform me how butter may be salted down to keep, say, four to six months.

The Dairy Division :—

Where no refrigerator is available, the butter should be salted with from $\frac{3}{4}$ oz. to 1 oz. of salt per pound, and a little butter-preservative added, amounting to, say, $\frac{1}{2}$ to 1 per cent. A parchment-lined white-pine box, or an earthenware jar with a glazed surface, make very good receptacles for holding the product. The cream should be held for sufficient time to develop a nice mild acid flavour before churning, and care should be taken to extract all the buttermilk by churning the cream at a low temperature and washing the grains of butter with cold water. When packed the butter should be placed in the coolest position possible and kept free from exposure to the air.

KILLING WILLOWS WITH SULPHURIC ACID.

"POHARA," Tahuna :—

I have a number of willows growing in a large creek. Will you kindly inform me of best method of killing the trees? Can poison be used?

The Horticulture Division :—

Willows can be destroyed by the use of sulphuric acid. Bore a few holes with an auger in the base of the tree, fill with sulphuric acid, and plug. The holes should be bored on an angle so as to better retain the liquid.

BUDDING OF FRUIT-TREES.

"SUBSCRIBER," Mount Albert, Auckland :—

I would be glad of a little information regarding budding fruit-trees. I have tried peaches on several occasions, both early and late, but with very little success. I generally find that as soon as the wet autumn rains come the buds which up to then had looked very promising have all been destroyed by "gumming" of the tree. What would be the best time for the Auckland District to bud peaches, apples, pears, and lemons?

The Horticulture Division :—

You should experience no great difficulty in budding peaches successfully, provided that the work is carefully done and the proper bud used. The bud must be a healthy mature leaf-bud, either single or the centre one of a triple set. Care must be taken in removing the wood from the shield of bark when preparing the bud for insertion, otherwise the wood will be torn out of the bud, which will then

fail to grow, and the subsequent result will be practically the same as that described by you. After inserting the bud the edges of incision should be held in place by lightly binding with raffia—the material generally used for this purpose. January and February are generally recognized to be the most suitable times for budding the classes of fruit mentioned, but the work can be successfully performed over a longer period. Budding generally is more likely to be successful if carried out shortly after a moderate fall of rain.

MILLET AS GREEN MANURE.

G. L., Te Puke :—

Is millet of any value to plough in for green manure? How does it compare with other things for that purpose—say, barley?

The Fields Division :—

Pound for pound barley contains a little more nitrogen and ash than millet, but as the latter would produce a greater bulk of green material it would equal, if not surpass, barley for green-manuring purposes. Of course, barley could be grown during winter for the same purpose when millet could not.

ARTICHOKES.

D. G. GORDON, Taoroa, Taihape :—

Could you give me information as to growing Jerusalem artichokes, and their value as pig-food? What kind of soil do they need, and are they subject to frost or blight?

The Fields Division :—

The two varieties of artichokes principally grown are the white and the purple-skinned. There is practically no difference between them. They provide good feed and shade for pigs, the pigs helping themselves to the tubers. Artichokes grow well even on gravelly or sandy soils that otherwise might be waste ground on the farm. The soil requires to be well worked, however. The tubers are planted out like potatoes in hills about 2 ft. apart in drills 3 ft. apart. Place one set in each hill. Potash manures give best results. We would advise a little superphosphate (about 1 cwt. per acre) and wood-ashes (3 cwt. to 4 cwt. per acre). The tubers can be planted in the early spring (August or early in September). They respond to systematic intercultivation as do potatoes. As far as is known, they are not usually affected with a blight of any kind.

LUCERNE ROOT-FUNGUS.

T. P., Ohaupo :—

Some sort of blight or decay has made its appearance in my lucerne. It starts in a few plants and gradually spreads, the tops turn yellow and die off, and the roots rot, so that when they are pulled they break off a few inches below the surface. The paddock was laid down in December, 1913, with 1 ton of lime per acre. The first affected patch appeared about twelve months ago. As soon as I noticed it I spread lime very thickly over it, and dug it in right back into the good lucerne, which checked it for some time, but it has gone on spreading this summer and several more patches have appeared. I am sending a sample of soil and decayed roots.

The Biology Section :—

The lucerne specimens forwarded are attacked by a fungus root-disease known as Rhizoctonia, which forms a dense mass of minute interweaving threads, mainly about the roots, upon which it lives parasitically. The roots of many other plants are attacked by this disease, notably beans, beet, carrot, cabbage tribe, and potatoes. Acidity of soil through poor drainage favours its spread, but the

application of lime in your case should have neutralized such an acid condition. Freshly decayed vegetable-matter also fosters this fungus. If the affected patches are small enough they could advisedly be well watered with a solution of sulphate of iron, using 1½ lb. to 3 gallons of water. This is destructive to the fungus threads in the soil, where they may otherwise persist for many years. Several applications of this wash may be found necessary. Where the affected patches are small they should have a trench dug round them a foot or two beyond where any diseased plants show, and the soil should be thrown on the inside of the trench. In addition to spraying with iron sulphate a dressing of burnt lime at as high a rate as from 1 to 2 tons per acre may be applied. Where this disease appears in lucerne great care has to be exercised in cultivation, and in no case should the cultivating-implement be allowed to pass over the affected patches. If this is allowed to occur wholesale infection of the field is likely to result. Plants that are quite dead should be dug out and burnt on the affected areas themselves. When the disease is general over a lucerne-field there is no practical method of control.

MOLASSES AND STOCK-FEEDING.

W. F. PANNETT, Scargill :—

Will you kindly afford me some information as to the nutritive value of molasses? Last winter I used five or six casks, and I find it very useful as an adjunct to chaff. I save the husk or chaff of wheat and mix molasses with it, and find the stock eat it well. I have never been able to obtain the results of an analysis showing its food-value, or any statements as to how much should be fed in a given time.

The Live-stock Division :—

The constituents of molasses are as follows (per cent.): Water, 92·0; albuminoids, 2·0; carbohydrates, 4·4; ash, 1·6. Molasses, when diluted with warm water and sprinkled on hay or mixed with chaff, stimulates the appetite, but is of itself of no great food-value. It should be used with discretion, as cases are on record of serious digestive troubles through encouraging animals to eat indigestible food by adding molasses.

ERADICATING WILD BUTTERCUPS.

"SUBSCRIBER," Makuri :—

I have a 5-acre paddock of newly cleared land on a river-flat. I had a good crop of rape on it last season, and there is still a lot of feed on the land. The wild buttercup has had possession of the land for years. Can you advise me the best way to get rid of it? I thought of laying the paddock down in Western Wolths grass in the spring for fattening bullocks.

The Fields Division :—

The most feasible way to deal with the wild buttercup would be to plough up the land between now and early spring, and cultivate with spring-tooth cultivator and tine harrows from, say, the end of August up to near the end of November. Cultivate fairly frequently during that period, then seed at the rate of at least 30 lb. Western Wolths and 4 lb. cow-grass per acre, using about 1 cwt. basic superphosphate and 1 cwt. blood-and-bone manure per acre. The systematic cultivation, together with the liberal grass-seeding, should beat the weeds.

TREATMENT OF ROOTS FOR PIG-FEED.

T. C., Ngaruawahia :—

Does it pay to boil swedes and mangels for pigs? I pulp them before boiling. Would the results be as good if I mixed the pollard dry with the raw pulp—same amount in each case?

The Live-stock Division:

It does not pay to boil swedes or mangels for pigs. Raw swede or mangel pulp mixed with pollard is excellent pig-feed, quite equal to boiled feed. This does not apply to potatoes, which must be cooked for pigs.

LUCERNE IN ORCHARDS.—POISONOUS HONEY.

G. S. Clarke, Kihikihi:—

Be good enough to inform me (1) whether lucerne would be injurious grown in between young fruit-trees, about 6 ft. from line of trees; (2) how honey should be treated to prevent (possible) poisoning.

The Horticulture Division:—

(1.) *Lucerne could be grown for a time between young trees on the lines* suggested without injury to the trees, provided the 6 ft. strip of soil between the lucerne and the trees were kept well worked.

(2.) Poisonous honey is gathered from two sources in New Zealand—viz., ranunculus (*rivularis*), a swamp-weed, and rangiora (*Brachyglottis repanda* and *B. rangiora*) shrubs. Honey gathered from these sources contains a volatile poison, which, in the process of ripening by the bees, is evaporated. Honey is ripe after having been capped by the bees, so that if no honey is extracted until capped there is no danger of injurious results.

CONTROLLING THE KEA PEST.

"Sufferer," Oamaru:—

Will you kindly inform the writer the most efficacious manner of treating the kea pest? Our station in Central Otago suffers very much from these birds. So far we have tried shooting them. Some stations, I believe, go in for poisoning, but the latter method is objectionable because the dogs run the risk of being poisoned by the carcases left for the keas.

The Live-stock Division:—

Shooting and poisoning are both recommended by those who have had experience with the kea pest. In this connection we may quote the remarks of *two reliable sheep-farmers with many years' experience on kea-infested country.* One says, "I consider that paying a fair price per head is the best way of getting quit of them." The other, who also does a great deal of shooting, states, "The best means I find of getting rid of keas is by poisoning with strychnine a sheep they have just killed. I have got as many as forty dead round one sheep."

CONTROL OF GRASS-GRUB.

J. A. Rayne, Carterton:—

I have a paddock which I have just sown down in grass and Cape barley. I notice that the grubs have started in it. Could you recommend anything to eradicate them?

The Fields Division:—

There is, unfortunately, nothing that could be applied to the land that would be feasible on a large scale. In general, we would advise breaking up your field often and growing temporary pastures until you rid the land of this troublesome pest. As clovers do not appear to be so readily attacked, make use of these as much as possible. Practise a short rotation. If you keep pigs or turkeys, turn them into the ploughed field, as they are good destroyers of the white grub. You should make a practice to grow temporary crops, making free use of clovers in them. The object is to keep the soil stirred up as much as possible. Do the ploughing in the autumn or early winter as far as possible, so as to expose to the frost.

After two or three years of a succession of temporary crops the land may be sown down with a permanent grass mixture, but not until the grubs have practically disappeared is it advisable for such mixture to be sown. Where the grub is bad only in patches a good heavy application of kainit to these spots has been recommended. Rolling the land heavily is also said to have some effect. Apterite or Vaporite has been used also as a spray for crops attacked by the white grub. These remedies may be of service to you where the grub is confined to small areas later on, but meantime the short rotation, embodying the use of temporary pastures of clover crops ("catch" or otherwise) with grain and root crops, is your best method of combating this difficult pest.

WOODLICE IN HIVES.—CROSS-MATING OF BEES.

"INQUIRER," Dannevirke :—

1. Can you tell me how to prevent "slaters" (woodlice) from entering and destroying comb in hives? The hives are about 9 in. off the ground.

2. I have the two races of Italian bees—Leather and Golden. Will the cross-mating of these two be in any way detrimental to the breeding of pure Italian stock? Are they looked upon as hybrids, and will it affect their ability to gather nectar?

The Horticulture Division :—

1. "Slaters," or woodlice, become prevalent in hives situated in damp places. Keep surrounding grass cut away and dry mats over the frames. A good unleakable cover should be on all hives. These insects do not usually cause material damage apart from being a nuisance and undesirable.

2. A cross between the Golden and Leather coloured Italians would not affect the honey-gathering qualities of either race, and they are not termed hybrids. Hybrids are a cross between the Black and Italian races.

METHOD OF APPLYING LIME.

CHARLES MCKENZIE, Ngaere :—

Would you kindly tell me through your *Journal* if it would kill seed to plant it with ground or burnt lime—I mean to run them both through the drill at the same time. Might not the lime when it gets on to the damp soil cause too much heat and so kill the germination?

The Fields Division :—

The sowing of seed and burnt lime together is not a desirable practice, because of the caustic action of the lime and so much of it coming in close contact with the germinating seed. You had better sow the lime separately, working it thoroughly through the soil when working up your land for the seed-bed. You could apply the lime on top of the ploughed ground and work it in with the disk and tine harrows.

WATTLE AND OTHER HEDGES.

"HEDGE," Makikihi :—

Could you inform me what kind of a fence wattle makes for a vegetable-garden, also for a road boundary-fence that has to be trimmed?

The Horticulture Division :—

Wattle will stand cutting, and can be made to serve either purposes mentioned by you, but for purely hedge purposes there are other plants preferable, such as Lombardy poplar for a boundary-fence, and *Pittosporum crassifolium*, broadleaf privet, or elaeagnus for the vegetable-garden. To provide a hedge quickly for the latter purpose tagasaste is very suitable.

ERADICATING RATSTAIL-GRASS.

O. M. C., North Auckland :—

Would you be so good as to advise what is the best method of treating limestone land that has been allowed to run to ratstail ?

The Fields Division :—

If your land is ploughable the method of eradication is first to plough shallow and let this lie for some time, particularly during a dry period of the year, then cross-plough deeper and work away with spring-tooth cultivator and tine harrows until you have brought all the grass to the surface, where it can dry out and die. To put the finishing-touch on this summer fallowing, seed heavily with rape or white mustard, to smother the grass. If the land is not ploughable it is practically impossible to eradicate the ratstail. The only feasible method that might be tried is to burn off the grass at the right time and broadcast a mixture of Kentucky blue-grass, cocksfoot, *Poa trivialis*, white clover, cow-grass, *Lotus angustissimus*, alsike, hard fescue, and a little Chewings fescue and *Danthonia pilosa*. Seed fairly liberally and when rain is imminent. Turning a good flock of sheep on to the sown area immediately afterwards should cause the seed to be trampled in and manured somewhat, thus giving the grass every chance of taking hold.

NOTICES.—The name of "Subscriber," Dannevirke, is required before his query regarding *C. macrocarpa* seed can be answered. The name, of course, will not be published.

A letter without signature of any sort, inquiring as to manurial advice, has been received from Enfield. It cannot be dealt with in its present form.

GRASS-SEED AND SMALL BIRDS.

Mr. J. H. Fleming, of Ongarue, sends particulars of a method for protecting surface-sown grass-seed from small birds, at small cost, as follows: Mix kerosene and turpentine in the proportion of 1 pint of turps. to 1 gallon of kerosene. When sowing tip about half a bushel of seed into the sowing-bag, then pour half a pint or a little more of the mixture over the seed, stirring the latter well at the same time. The seed will not get sticky unless too much of the mixture is used. Mr. Fleming says that he has overcome the nuisance by this means, and adds that in his case the birds now have all the worry.

FORTHCOMING AGRICULTURAL SHOWS.

Manawatu and West Coast A. and P. Association: Winter Show at Palmerston North, 20th to 23rd June.

South Taranaki Winter Show Company (Limited): Dominion Dairy Show at Hawera, 4th to 8th July.

A Commonwealth Proclamation last year prohibited the importation of citrus plants from any part of the world into Australia, but the prohibition did not extend to citrus fruits. The latter provision has now been modified, to the effect that citrus fruits may be imported only from countries in which the disease citrus-canker or Japanese canker does not exist.

A HILLSIDE APIARY IN THE GISBORNE DISTRICT.

COMMERCIAL INTELLIGENCE.

LONDON WOOL-SALES.

FOLLOWING are the High Commissioner's cabled market reports regarding the fourth series of London wool-sales:—

30/5/16.—The wool-sales have opened with strong competition and a large attendance of buyers. Merinos and fine crossbreds are 1d. per pound higher; medium and coarse crossbreds are firm at the closing prices of last sales. The total net quantity of New Zealand wool available is 28,500 bales.

8/6/16.—The wool-sales have closed firm for all kinds of wool. There has been an active demand by Home buyers. Prospects for all wools at next series are favourable. Estimated values now are: Fine crossbreds, 1s. 10d. to 2s.; medium crossbreds, 1s. 5d. to 1s. 8d.; coarse crossbreds, 1s. 3d. to 1s. 6d.; superior merino, 1s. 9d. to 1s. 11d.; medium merino, 1s. 5d. to 1s. 8d.; inferior merino, 1s. 1d. to 1s. 4d. The total net quantity of New Zealand wool held over is 5,000 bales.

IMPORTATION OF LIVE-STOCK.

IN accordance with the regulations under the Stock Act, 1908, for the prevention of the introduction into New Zealand of diseases affecting stock, the following places have been appointed as the ports from which the kinds of live-stock mentioned must be shipped when intended for importation into the Dominion:—

Name of Country.	Kinds of Live-stock.	Ports appointed.
United States	Horses, mules, and asses	San Francisco.
Canada	Horses, mules, asses, and cattle	Vancouver.
France	Asses	Havre and Marseilles.
Spain	,,	El Ferrol.
Portugal	,,	Lisbon.

In the case of the United Kingdom, London, Liverpool, and Glasgow are the ports appointed by the regulations for the shipment of live-stock to New Zealand.

The following veterinarians have been appointed in the countries mentioned for the inspection of live-stock intended for exportation to New Zealand:—

UNITED KINGDOM: The Veterinary Officer attached to the office of the High Commissioner for New Zealand, or any veterinarian nominated by the High Commissioner, for the ports of London, Liverpool, and Glasgow.

CANADA: Any veterinarian in the employ of the Canadian Government for the Port of Vancouver.

UNITED STATES: Any veterinarian in the employ of the United States Government for the Port of San Francisco.

FRANCE: Any veterinarian nominated by the British Con ul-General at Havre or Marseilles for these ports respectively.

SPAIN: Any veterinarian nominated by the British Consul at Corunna for the Port of El Ferrol.

PORTUGAL: Any veterinarian nominated by the British Consul at Lisbon for that port.

COMPILED FROM MANIFESTS OF VESSELS SAILED DURING RESPECTIVE MONTHS OF CURRENT AND PRECEDING SEASONS.

Month.		Mutton, Carcases.	Lamb, Carcases.	Beef, Quarters.	Pork, Carcases.	Butter, Boxes.	Cheese, Crates.	Wool, Bales.	Wheat, Sacks.	Oats, Sacks.	Rabbits, Crates.	Hemp, Bales.	Tow, Bales.	Kauri-gum, Pkgs.
January,	1916	166,700	295,170	41,726	179	108,593	101,917	92,849	..	..	..	7,438	1,666	1,218
,,	*1915*	*137,816*	*296,439*	*45,622*	*339*	*138,081*	*85,123*	*87,393*	..	..	*2,860*	*683*	..	*1,209*
February,	1916	170,973	266,414	29,056	23	96,096	84,740	96,016	..	..	..	8,161	1,804	1,900
,,	*1915*	*433,585*	*517,581*	*77,421*	*311*	*119,371*	*96,090*	*159,347*	..	..	..	*13,111*	*6,619*	*2,763*
March,	1916	327,977	363,269	83,725	..	59,671	62,082	49,750	..	..	474	2,666	637	1,247
,,	*1915*	*80,439*	*203,480*	*30,176*	..	*55,280*	*51,811*	*49,809*	..	..	..	*8,410*	*185*	*274*
April,	1916	108,488	195,707	106,369	..	24,703	81,652	41,725	..	..	..	3,782	337	450
,,	*1915*	*286,155*	*328,779*	*45,340*	..	*6,703*	*38,561*	*41,371*	..	..	*1,011*	*9,328*	*1,474*	*3,461*
May,	1916	170,164	282,156	134,971	..	26,789	56,961	26,356	..	..	1,000	2,892	235	731
,,	*1915*	*257,953*	*433,831*	*34,780*	*655*	*148*	*17,065*	*21,615*	..	..	*2,923*	*4,968*	*808*	*2,636*
June,	1915	99,080	154,785	19,316	932	..	26,869	11,946	..	..	9,800	5,027	1,320	1,229
,,	*1914*	*261,877*	*634,981*	*36,400*	..	*1,153*	*19,247*	*18,774*	..	*28,141*	*1,000*	*7,924*	*4,258*	*7,881*
July,	1915	243,420	340,476	21,231	154	..	21,520	16,039	..	..	5,968	5,068	1,639	4,184
,,	*1914*	*225,411*	*239,143*	*38,170*	..	*1,355*	*2,003*	*15,868*	..	*1,425*	*1,000*	*5,810*	*2,584*	*8,053*
August,	1915	510,418	570,381	51,750	35	..	18,287	19,416	..	..	31,790	7,138	1,466	4,848
,,	*1914*	*84,251*	*63,111*	*19,094*	*516*	*1,979*	*50*	*4,845*	*600*	*38,220*	*10,403*	*367*	*245*	*3,705*
September,	1915	299,715	330,643	59,487	..	26,416	2,595	5,360	..	..	7,750	2,022	3,091	595
,,	*1914*	*53,386*	*49,200*	*2,353*	..	*15,885*	..	*3,337*	..	*5,896*	*7,288*	*1,143*	*57*	..
October,	1915	307,198	417,794	87,104	..	111,468	49,160	7,272	..	..	56,636	5,650	1,645	1,230
,,	*1914*	*291,432*	*128,016*	*49,104*	..	*81,842*	*30,487*	*8,938*	..	*68,660*	*38,121*	*2,042*	*1,650*	*1,683*
November,	1915	93,777	92,601	21,609	..	81,102	47,243	18,715	..	..	13,538	5,064	1,789	868
,,	*1914*	*136,346*	*27,577*	*48,302*	*27*	*98,729*	*70,048*	*37,604*	*15*	*24,289*	*35,783*	*885*	*110*	*1,377*
December,	1915	91,124	59,231	36,467	..	214,967	81,939	33,527	..	..	3,052	6,016	1,940	5,555
,,	*1914*	*192,952*	*149,835*	*44,876*	..	*172,990*	*80,144*	*86,317*	..	..	*9,306*	*1,136*	*116*	*2,157*

LONDON MARKET VALUES.

COMPARATIVE STATEMENT COMPILED FROM THE HIGH COMMISSIONER'S CABLES FOR THE PAST THREE MONTHS.

London Date.	Wool. Bradford Quotations for Tops.						Mutton.		Lamb.		Beef.		Butter.		Cheese.			Hemp (Spot).			Hemp (Forward Shipment).			Wheat.		Oats.	
	36's.	40's.	44's.	50's.	56's.	60's.	Canterbury.	North Island.	Canterbury.	Other than Canterbury.	New Zealand Hinds.	New Zealand Fores.	Danish.	New Zealand.	New Zealand White.	New Zealand Coloured.	Canadian.	New Zealand Good-fair.	New Zealand Fair.	Manila Fair (New Grade).	New Zealand Good-fair.	New Zealand Fair.	Manila Fair (New Grade).	N.Z. Short-berried.	N.Z. Long-berried.	N.Z. Sparrowbills.	N.Z. Danish.
1916.							d.	d.	d.	d.	d.	d.															
March 11	..	..	..	..	..	..	7⅝	7⅝	8¼	*8¾	..	..	182/0	163/0	99/0	99/0	103/0	47/0/0	45/10/0	57/0/0	46/10/0	44/10/0	56/0/0	..	..	..	..
„ 18	..	..	..	..	..	..	7⅝	7⅝	8¼	*8¾	6½	5½	181/0	163/0	102/0	103/0	105/0	..	46/0/0	56/10/0	46/5/0	44/5/0	55/0/0	..	..	..	..
„ 25	..	..	..	..	..	..	7⅞	7⅞	*9	*9	..	..	178/0	163/0	102/0	103/0	106/0	..	..	55/0/0	..	45/5/0	..	..	..	..	..
April 1	..	..	..	..	..	..	7⅞	7⅞	*9	*9	..	..	172/0	163/0	103/0	103/0	107/0	47/10/0	45/10/0	..	46/10/0	44/10/0	..	..	..	..	..
„ 8	..	..	..	..	..	..	7⅞	7⅞	8¾	8¾	7	6	174/0	163/0	103/6	103/6	107/0	49/0/0	47/0/0	54/0/0	47/10/0	45/10/0	53/0/0	..	..	..	..
„ 15	..	..	..	..	..	..	7⅞	7⅞	8¾	8¾	7	6	175/0	163/0	105/0	105/0	107/0	49/10/0	47/10/0	53/0/0	50/0/0	47/0/0	..	..	..	..	..
„ 20	..	..	..	..	..	..	7⅞	7⅞	8¾	8¾	..	..	173/0	163/0	105/0	105/0	108/0	49/10/0	..	55/0/0	48/10/0	46/15/0	51/10/0	..	..	..	..
„ 29	..	..	..	..	..	..	7⅞	7⅞	8¾	8¾	..	..	169/0	163/0	107/0	107/0	109/0	49/0/0	47/0/0	..	..	..	..	..	..	..	..
May 6	..	..	..	..	..	..	7⅞	7⅞	8¾	8¾	6½	6	170/0	164/0	110/0	110/0	112/0	50/0/0	48/0/0	..	48/10/0	46/10/0	54/10/0	..	..	..	..
„ 13	..	..	..	..	..	..	8⅛	8⅛	9	9	..	..	172/0	165/0	113/0	113/0	115/0	50/0/0	48/0/0	56/0/0	49/0/0	47/0/0	55/0/0	..	..	..	..
„ 20	..	..	..	..	..	..	8⅝	8⅝	9½	9½	..	..	172/0	169/0	114/6	113/6	115/9	49/10/0	47/10/0	55/0/0	48/0/0	46/0/0	54/0/0	..	..	..	..
„ 27	..	..	..	..	..	..	†8⅝	..	†8½	..	8	7¼	172/0	169/0	113/0	112/0	116/0	49/10/0	47/10/0	53/10/0	48/0/0	46/0/0	53/0/0	..	..	..	..
June 3	..	..	..	..	..	..	†8⅝	..	†9½	..	..	..	174/0	169/0	108/0	105/0	105/0	49/10/0	47/10/0	53/10/0	48/0/0	46/0/0	53/0/0	..	..	..	..
„ 10	..	..	..	..	..	..	†8⅝	..	†9½	..	7¾	6¾	176/0	170/0	110/0	106/0	105/0	49/10/0	47/10/0	53/0/0	48/0/0	46/0/0	51/0/0	..	..	..	..

* New season's. † Specified in cable as "New Zealand."

STOCK EXPORTED.

THE following table shows the numbers and descriptions of stock exported from the Dominion during the month of May, 1916:—

Port of Shipment.	Horses.		Sheep.		Cattle.		Pigs.
	To Australia.	To Eastern Pacific.	To Australia.	To Eastern Pacific.	To Australia.	To Eastern Pacific.	To Eastern Pacific.
Auckland	3	10	..	284	..	3	14
Gisborne	..	..	..	..	..	..	..
Napier	2	1	..	..	..	..	..
Wellington	2	..	100	..	..	..	..
Lyttelton	7	..	..	..	..	..	..
Dunedin	1	..	170	..	..	..	..
Bluff	..	..	..	..	..	..	..
Totals	15	11	270	284	..	3	14

Auckland also exported 19 crates of poultry and 24 mules to eastern Pacific.

The following are particulars of horses shipped: Thoroughbred, 2 stallions, 4 mares, 2 geldings, 1 colt; Clydesdale, 1 stallion, 1 mare; draught, 2 stallions, 1 filly, 6 medium and 4 light draught mares; 2 pony stallions.

STOCK IN QUARANTINE.

THE following stock was received into quarantine during the month of May, 1916:—

No.	Description.	Sex.	Port of Origin.	Owner or Agent.	Address.
			MOTUIHI ISLAND (AUCKLAND).		
1	Fox-terrier ..	Male ..	London ..	Mrs. H. F. Wilton	Auckland.
1	Crossbred terrier	,,	,, ..	,,	..
			SOMES ISLAND (WELLINGTON).		
2	Berkshire boars	Male ..	Sydney ..	Symons Bros. (agent, N.Z. Express Co.)	Thorndale, Taranaki.
1	Cocker spaniel ..	,,	Plymouth..	Captain J. G. Williams, Government House	Wellington.
			QUAIL ISLAND (LYTTELTON).		
			Nil.		

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HEMP AND TOW GRADING RETURNS.

MAY.

Hemp.—The total number of bales graded was 10,841, as compared with 9,463 for the corresponding month of last year, an increase of 1,378 bales. For the twelve months ending 31st May, 1916, the number of bales graded was 143,436, as compared with 83,049 for the previous twelve months, an increase of 60,387 bales.

Tow.—During the month 2,268 bales were dealt with, as compared with 2,535 for the corresponding month of last year, a decrease of 267 bales. For the twelve months ending 31st May, 1916, the number of bales graded was 39,393, as compared with 22,616 for the previous twelve months, an increase of 16,777 bales.

Stripper-slips.—The number of bales graded was 303, as compared with 99 for the corresponding month of last year, an increase of 204 bales. For the twelve months ending 31st May, 1916, the number of bales graded was 6,458, as compared with 1,414 for the previous twelve months, an increase of 5,044 bales.

HEMP, TOW, AND STRIPPER-SLIPS GRADED THROUGHOUT THE DOMINION DURING THE MONTH OF MAY, 1916.

Hemp.

Port.	Superior.	Fine.	Good-fair.	Fair.		Common.	Rejected.	Condemned.	Total.
				High Point.	Low Point.				
	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.	Bales.
Auckland ..	..	..	23	1,033	1,568	373	41	1	3,039
Napier ..	..	..	..	..	..	..	..	..	..
Foxton ..	..	..	667	1,085	298	5	16	..	2,071
Wellington ..	..	13	501	2,448	367	42	8	..	3,379
Picton ..	..	72	26	..	..	..	..	..	98
Blenheim ..	..	..	199	65	23	4	..	..	291
Lyttelton ..	..	..	..	..	..	..	..	..	..
Dunedin ..	..	..	131	173	153	15	..	..	472
Bluff	..	..	166	445	722	137	21	..	1,491
Totals ..	..	*85*	*1,713*	*5,249*	*3,131*	*576*	*86*	*1*	*10,841*
Percentages of totals	..	0·78	15·80	48·42	28·88	5·32	0·79	0·01	..

Tow.

Port.	First Grade.	Second Grade.	Third Grade.	Condemned.	Total.
	Bales.	Bales.	Bales.	Bales.	Bales.
Auckland ..	..	271	623	137	1,031
Napier	..	..	..	..	..
Foxton	214	57	4	..	275
Wellington ..	58	13	49	..	120
Picton	..	40	..	..	40
Blenheim ..	52	125	..	..	177
Lyttelton ..	..	..	..	..	..
Dunedin ..	..	86	30	1	117
Bluff	..	87	393	28	508
Totals ..	*324*	*679*	*1,099*	*166*	*2,268*

Stripper-slips.—Foxton: Second grade, 150; condemned, 1. Wellington: First grade, 14; second grade, 96; condemned, 5. Blenheim: Second grade, 28. Dunedin: Condemned, 3. Bluff: Second grade, 6.